Preliminary Condition Assessments of
Existing Bulkheads at Fisherman's Wharf Marina
Port of Fort Pierce
Fort Pierce, St. Lucie County, Florida

November 21, 2016

Prepared for:

St. Lucie County – Public Works Department
2300 Virginia Avenue
Fort Pierce, Florida 34982

Prepared by:

Dredging & Marine Consultants, LLC
200 South Indian River Drive, Suite 305
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Dredging & Marine Consultants
DMC
ENGINEERS • SCIENTISTS

November 21, 2016
DMC Project No. 16-002-30

Mr. Kyle Croce, P.E.
Port Engineer
St. Lucie County – Public Works Department
2300 Virginia Avenue
Fort Pierce, Florida 34982

Re: **Summary Cover Letter**
Preliminary Condition Assessments of
Existing Bulkheads at Fisherman's Wharf Marina
Port of Fort Pierce
Fort Pierce, St. Lucie County, Florida

Dear Mr. Croce:

As requested, **Dredging & Marine Consultants, LLC (DMC)** has completed the preliminary condition assessments of the existing bulkheads at the above referenced project site, which is attached to this letter. An electronic copy of this report will also be provided.

In brief, based on our observations and review of the available information presented herein, we conclude that the subject bulkheads range from **Poor to Critical Condition**. The bulkhead conditions of the six (6) subject parcels observed are as follows:

- 600 North Indian River Drive – **Serious to Critical Condition**
- 125 Fisherman's Wharf – **Serious to Critical Condition**
- 201 Fisherman's Wharf – **Poor to Serious Condition**
- 219 Fisherman's Wharf – **Poor Condition**
- 221 Fisherman's Wharf – **Critical Condition**
- Eastern Terminus of Fisherman's Wharf Roadway – **Serious to Critical Condition**

Special attention is directed to the bulkheads listed above in **Serious** and **Critical** condition, which are in need of repairs and/or total replacement on a high-priority basis with urgency (**Serious**) and on a very high-priority basis with strong urgency (**Critical**).

We appreciate the assistance you, the City of Fort Pierce, the St. Lucie County Regional History Center and the Florida Department of Transportation have provided us in this phase of the project. Please contact us if any questions arise, or if we may be of service in any way.

Respectfully,
Dredging & Marine Consultants, LLC

11-22-16

Will B. Cornelius II, P.E.
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Dredging & Marine Consultants
DMC
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November 21, 2016
DMC Project No. 16-002-30

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Port Engineer
St. Lucie County – Public Works Department
2300 Virginia Avenue
Fort Pierce, Florida 34982

Re: Preliminary Condition Assessments of Existing Bulkheads at Fisherman's Wharf Marina Port of Fort Pierce Fort Pierce, St. Lucie County, Florida

Dear Mr. Croce:

As requested, **Dredging & Marine Consultants, LLC (DMC)** has completed the preliminary condition assessments of the existing bulkheads at the above referenced project site. The purposes of the inspection program were to review available information of the existing bulkheads, to observe the conditions of the subject bulkheads in general accordance with a Level I inspection as outlined in the 2015 ASCE *Waterfront Facilities Inspection and Assessment* manual, and to provide our recommendations based on the conditions observed.

EXECUTIVE SUMMARY

In brief, based on our observations and review of the available information presented herein, we conclude that the subject bulkheads range from **Poor to Critical Condition**. The bulkhead conditions of the six (6) subject parcels observed are as follows:

- 600 North Indian River Drive – **Serious to Critical Condition**
- 125 Fisherman's Wharf – **Serious to Critical Condition**
- 201 Fisherman's Wharf – **Poor to Serious Condition**
- 219 Fisherman's Wharf – **Poor Condition**
- 221 Fisherman's Wharf – **Critical Condition**
- Eastern Terminus of Fisherman's Wharf Roadway – **Serious to Critical Condition**

The condition assessment ratings discussed herein are in accordance with the ratings presented in Table 2-14 of the 2015 ASCE *Waterfront Facilities Inspection and Assessment* manual, which is presented as Figure 1 below for reference.

Special attention is directed to the bulkheads listed above in **Serious** and **Critical** condition and the associated rating descriptions in Figure 1 below, which states that repairs may need to be carried out on a <u>high-priority basis with urgency</u> (**Serious**) and on a <u>very high-priority basis with strong urgency</u> (**Critical**).

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Table 2-14. Condition Assessment Ratings

Rating		Description
6	Good	No visible damage or only minor damage noted. Structural elements may show very minor deterioration, but no overstressing observed. No repairs are required.
5	Satisfactory	Limited minor to moderate defects or deterioration observed but no overstressing observed. No repairs are required.
4	Fair	All primary structural elements are sound but minor to moderate defects or deterioration observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the load-bearing capacity of the structure. Repairs are recommended, but the priority of the recommended repairs is low.
3	Poor	Advanced deterioration or overstressing observed on widespread portions of the structure but does not significantly reduce the load-bearing capacity of the structure. Repairs may need to be carried out with moderate urgency.
2	Serious	Advanced deterioration, overstressing, or breakage may have significantly affected the load-bearing capacity of primary structural components. Local failures are possible, and loading restrictions may be necessary. Repairs may need to be carried out on a high-priority basis with urgency.
1	Critical	Very advanced deterioration, overstressing, or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur, and load restrictions should be implemented as necessary. Repairs may need to be carried out on a very high-priority basis with strong urgency.

Figure 1. *Reproduction of Table 2-14 from the 2015 ASCE Waterfront Facilities Inspection and Assessment manual.*

We have also identified safety hazards with some of subject bulkheads that require immediate attention and preventative measures, specifically:

- 600 North Indian River Drive:
  - Safety hazard from the spalled concrete elements located along the boat ramp staging dock for boaters and their passengers wearing minimal foot protection.

- 221 Fisherman's Wharf:
  - Safety hazard from unauthorized fishing activities observed on the decaying eastern and southeastern bulkheads, and on the decaying concrete pole gravity block wall.

- Eastern Terminus of Fisherman's Wharf Roadway:
  - Safety hazard from unauthorized fishing activities observed on the bulkhead.

SITE LOCATION AND GENERAL DESCRIPTION

The Fisherman's Wharf area of the Port of Fort Pierce acts as a buffer between the working port area and historic downtown Fort Pierce, and is bounded by Seaway Drive (S.R. A1A) to the south, US Highway 1 to the west, and Avenue H and the Fishermans Wharf roadway to the north, in Fort Pierce, St. Lucie County, Florida (Section 3, Township 35 South, Range 40 East). The general site location of the Fisherman's Wharf Marina is shown superimposed on a reproduction of the 2016 aerial photograph (presented as Figure 2 below) which was obtained on-line from the Florida Department of Transportation's (FDOT) Aerial Photo Look Up System (APLUS) website.

Figure 2. *Area map of the Fisherman's Wharf Marina.*

More specifically, the subject bulkheads associated with the Fisherman's Wharf Marina are bounded by the S.R. A1A Peter P. Cobb Memorial Bridge (FDOT Bridge No. 940094) to the south, North Indian River Drive to the west, and the Fishermans Wharf roadway to the north. Due to the variety of the bulkhead types present at the Fisherman's Wharf Marina, our inspections grouped the six (6) parcels into three (3) general areas (from south to north), as summarized in Table 1 below. In addition, these areas and their approximate parcel boundaries are shown superimposed on a reproduction of the 2016 aerial photograph which was obtained on-line from the St. Lucie County Property Appraiser's website, presented as Figure 3 below.

It is our understanding that the subject bulkheads are being considered for repair or replacement in the near future. We further understand that other improvements under consideration for the Fisherman's Wharf Marina include dredging the marina basin and widening the Black Pearl Boat Ramp, located at 600 North Indian River Drive.

Table 1. *Summary of Bulkhead Inspection Areas*

DMC Inspection Area	Parcel Address	Parcel No. In Figure 3 Below	Approximate Length of Bulkhead (feet)	General Direction of Bulkhead
Area 1	600 North Indian River Drive	3	120±	SE – NW
	125 Fisherman's Wharf	4	96±	SE – NW
			60±	SW – NE
	201 Fisherman's Wharf	5	284±	W – E
Area 2	219 Fisherman's Wharf	6	63±	SW – NE
	221 Fisherman's Wharf *	7 *	130± *	W – E
			30± *	SE – NW
Area 3	Eastern Terminus of Fisherman's Wharf Roadway	--	10±	SW – NE
			50±	SE – NW

** Note, bulkheads are currently damaged and no longer connect at the southeast corner of the parcel to form a continuous bulkhead.*

Figure 3. *Parcels 3 through 5 (Area 1), Parcels 6 and 7 (Area 2), and the eastern terminus of the Fishermans Wharf roadway (Area 3) associated with the Fisherman's Wharf Marina.*

REVIEW OF HISTORICAL AERIAL PHOTOGRAPHS

Based on our review of historical aerial photographs and from information provided by the client and the St. Lucie County Regional History Center, we understand that land reclamation activities for the creation of the Port of Fort Pierce began in the 1920s, using soils that were obtained from the excavation of the Fort Pierce Inlet, as shown in the 1921 aerial photograph (presented as Figure 4 below) which was obtained from the St. Lucie County Regional History Center. We note that the original causeway bridge to South Hutchinson Island is also shown in the 1921 aerial photograph below.

Figure 4. *Aerial view (facing east) of the land reclamation activities for Port of Fort Pierce, circa 1921.*

Additional land reclamation activities occurred at the Port of Fort Pierce between approximately 1952 and 1958 for the southern portions of the parcels located at 201, 219 and 221 Fisherman's Wharf, and for the creation of the parcels located at 125 Fisherman's Wharf and 600 North Indian River Drive. The additional land reclamation activities in these areas can be seen by comparing the 1952 and 1958 aerial photographs presented as Figures 5 and 6 below.

Figure 5. *1952 Aerial photograph of the Port of Fort Pierce, before the additional land reclamation activities.*

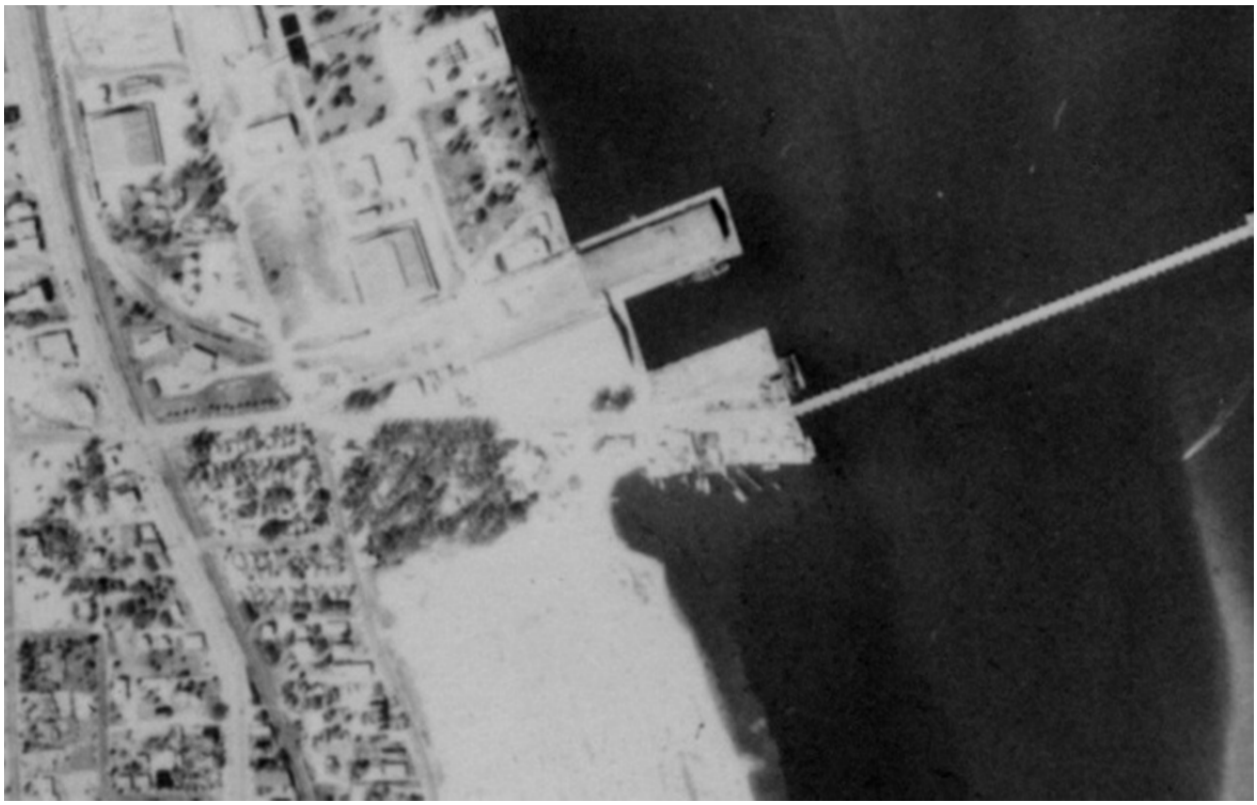


Figure 6. *1958 Aerial photograph of the Port of Fort Pierce, showing additional land reclamation activities.*

As seen in Figures 4 through 6 above, the western end of the previous causeway to South Hutchinson Island was located at the eastern end of the Fisherman's Wharf roadway until 1974, when construction of the S.R. A1A Peter P. Cobb Memorial Bridge completed. The approximate alignment of the Peter P. Cobb Memorial Bridge while under construction is shown (noted as *"Br under constr. (approx..)"*) on a reproduction of the 1972 Fort Pierce, Florida, National Ocean Survey (NOS) Coastal Zone Map, presented as Figure 7 below.

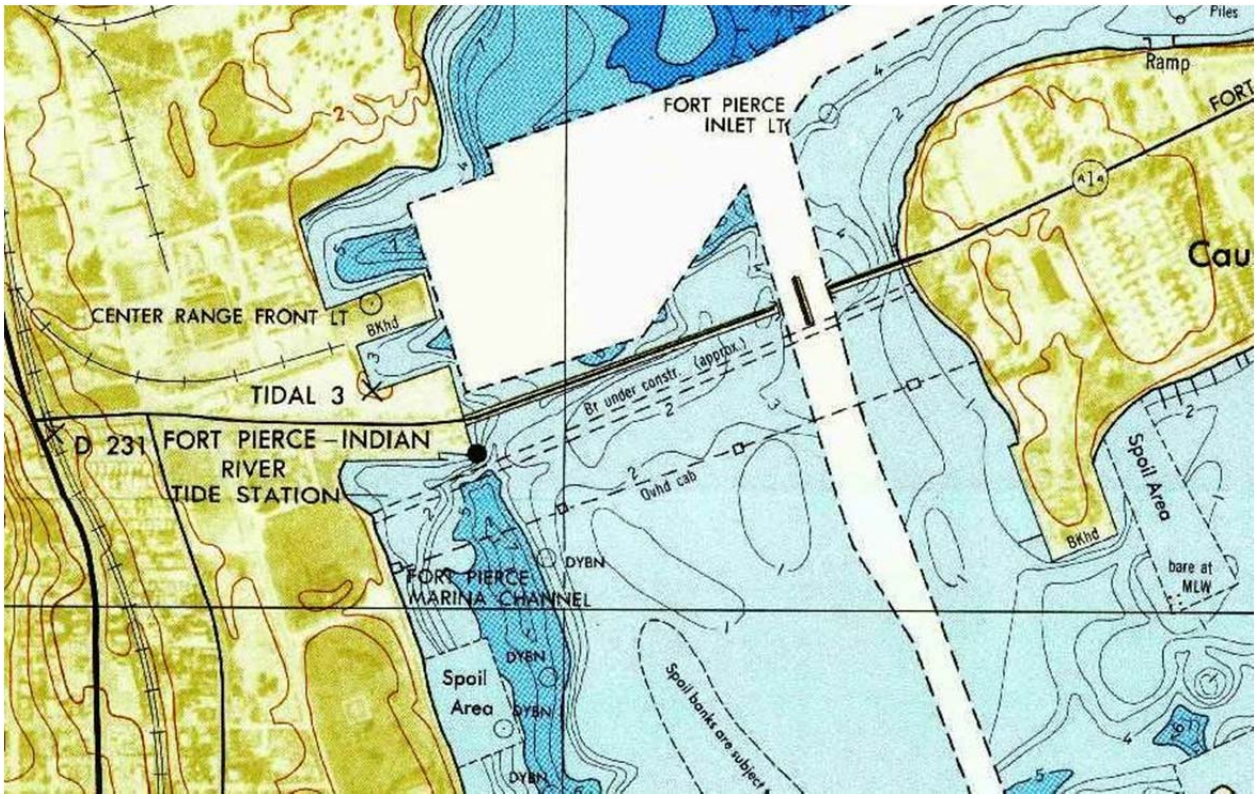


Figure 7. *Reproduction of the 1972 NOS Coastal Zone Map of Fort Pierce, Florida.*

REVIEW OF PUBLISHED INFORMATION AND SITE OBSERVATIONS

General

The following sections are specific for each subject parcel within the Fisherman's Wharf Marina and present the background information that we were able to locate during our searches, and our observations of the subject bulkheads.

Visual inspections were performed from the landward side of the bulkheads between July 1 and October 20, 2016 by DMC engineer Will Cornelius, P.E. In addition, visual inspections were performed from the seaward side of the bulkheads during low tide on August 26, 2016. Photographs from our inspections that are representative of the distresses observed are included in the following sections below, and additional photographs are provided in Appendix I.

Sources used for our electronic search of published documents relevant the design and construction of the bulkhead structures at Fisherman's Wharf Marina included searches of websites of the St. Lucie County Public Works Department and numerous other local, state and federal agencies. The FDEP Facility/Site ID(s) for each of the parcels were obtained from their on-line DEP Information Portal website, and are presented in Table 2 below.

Table 2. *Summary of FDEP Facility/Site ID(s)*

Parcel Address	FDEP Facility/Site ID
600 North Indian River Drive	ERP_195182
125 Fisherman's Wharf	SQG_140052
201 Fisherman's Wharf	ERP_204089
219 Fisherman's Wharf	SQG_86533
	FLA187593
	ERP_163860
221 Fisherman's Wharf	
Eastern Terminus of Fisherman's Wharf Roadway	ERP_139381

Our physical search of published documents included visits to the City of Fort Pierce Building Department to conduct permit searches for each of the subject parcels, and visits to the FDOT District 4 Treasure Coast Operations office and the St. Lucie County Regional History Center to discuss with staff. Unfortunately, all reportedly did not archive the very specific historical information sought.

It is important to note that our searches for published documents were unable to discover any specific details or plans from the design or construction of any of the subject bulkhead structures; therefore, important structural details necessary for a complete engineering evaluation of the existing structures (e.g., wall thickness, wall depths, driven king pile depths, date constructed) are unknown. Further, we note that due to the lack of original design or construction plans, this preliminary evaluation of the existing structures will rely more on the ancillary background information obtained for general insight into the history of these structures.

We contacted a local consulting engineering firm that specializes in non-destructive testing of foundations regarding the possibility of performing low-strain impact Pile Integrity Tests (PIT) on some of the bulkhead elements to gain some insight into the details and dimensions of the bulkheads. However, based on their review of the photographs provided, due to the amount and severity of cracking observed in the bulkhead elements, they do not believe that PIT testing will produce viable results.

Documents obtained from our searches related to the history of the subject parcels that assisted in our evaluation discussed herein are provided in Appendix II.

Background Information Obtained – Entire Fisherman's Wharf Marina

The Flood Insurance Rate Map (FIRM) of St. Lucie County, Florida and Incorporated Areas (Panel 179 of 420), which was issued by the Federal Emergency Management Agency (FEMA), states that the three (3) flood insurance rate zones within the subject site are *Zone AE, Zone VE* and *Zone X*. We note that the subject bulkheads appear to be located within *Zone VE*, which corresponds to the *"1% Annual Chance"* coastal floodplains that have additional hazards associated with storm waves. The Fisherman's Wharf area is shown on a reproduction of the 2012 FEMA map presented as Figure 8 below, and the full map is provided in Appendix II.

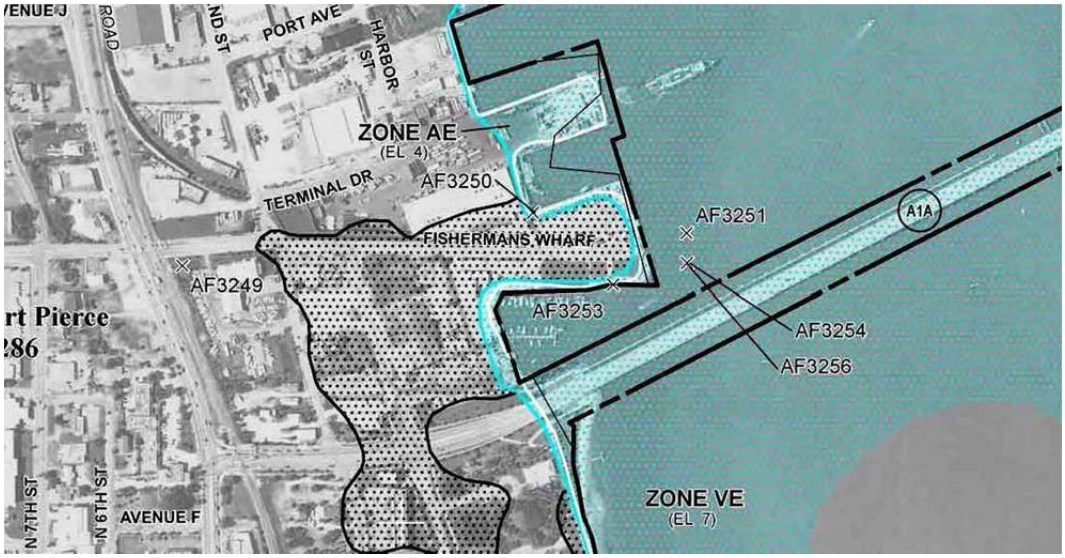


Figure 8. *Reproduction of the FEMA Flood Insurance Rate Map (FIRM) for St. Lucie County, Florida.*

The City of Fort Pierce City Wide Stormwater Master Plan, which was prepared by Kimley-Horn and Associates, Inc. (KHA) in February, 2010 includes a map of the Moore's Creek North Canal Basin Existing Stormwater Facilities. This map includes the Fisherman's Wharf, and shows the general locations of a 30-inch stormwater pipe and associated stormwater outfall located near the northern edge of the parcel located at 600 North Indian River Drive. A reproduction of this map is presented as Figure 9 below, and the full map is provided in Appendix II.

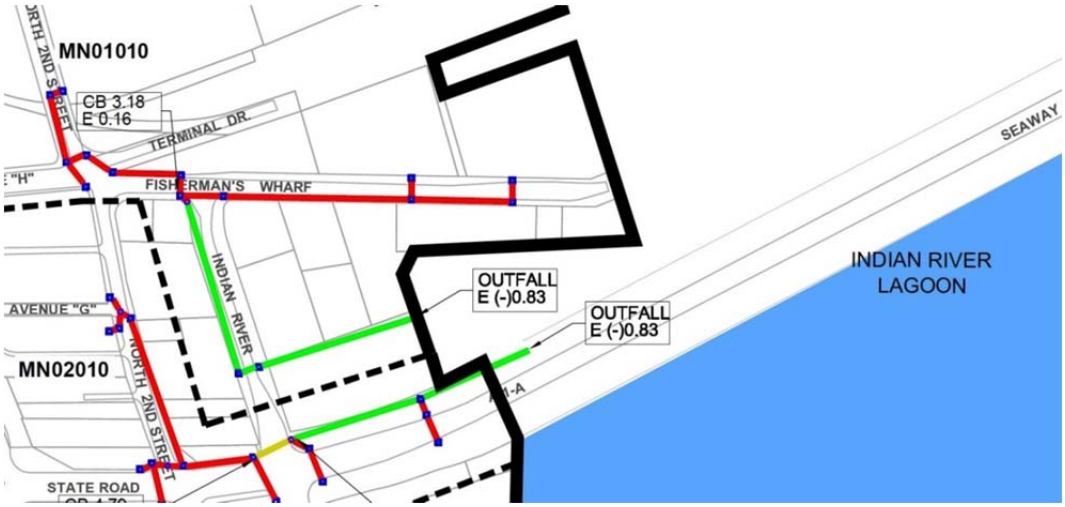


Figure 9. *Reproduction of the February, 2010 Moore's Creek North Canal Basin – Existing Stormwater Facilities map, prepared by Kimley-Horn and Associates, Inc.*

We note that during this phase of the project, between October 6 and 7, 2016, the Fisherman's Wharf Marina was subject to the elevated winds and other forces associated with the Hurricane Matthew storm events. The maximum wind gust data recorded in the general vicinity of the Port of Fort Pierce during this event was obtained for the weather sensor located at the St. Lucie County International Airport from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) website, and from the Harbor Branch Oceanographic Institute's (HBOI) Land/Ocean Biogeochemical Observatory (LOBO) website for the weather sensor designated *"Indian River Lagoon – Link Port"*. The maximum wind gust data recorded from these two weather sensors are summarized and presented in Table 3 below.

Table 3. *Summary of Maximum Wind Gust recordings near Fisherman's Wharf between October 6 and 7, 2016*

Weather Sensor Name	Approximate Latitude And Longitude	Approximate Distance and Direction from Fisherman's Wharf (miles)	Maximum Wind Gust October 6 and 7, 2016 (mph)	Associated Wind Direction (degrees)
St. Lucie County International Airport	N 27º 29' 53.02" W 80º 22' 36.01"	4.5± miles NW of Fisherman's Wharf	68	310
HBOI / LOBO Indian River Lagoon – Link Port	N 27º 32' 5.39" W 80º 20' 35.21"	5.7± miles N-NW of Fisherman's Wharf	73	335

Area 1 – 600 North Indian River Drive

Figure 10. *600 North Indian River Drive parcel outlined in yellow.*

Background Information Obtained

Based on our review of the aerial photographs, the parcel located at 600 North Indian River Drive appears to have been developed between 1970 and 1980; however, based on our observations, the bulkhead located to the north of the boat ramp appears to be continuous with the bulkhead to the north at 125 Fisherman's Wharf.

Our search from the DEP Information Portal yielded pages from a 1999 report by Taylor Engineering, Inc., which presents the results of their 1999 assessment (with photographs) of the Black Pearl Boat Ramp for the St. Lucie County Leisure Services Department. This document is included for reference in Appendix II.

Site Observations

The 120± linear foot bulkhead to the north of the boat ramp appears to consist of precast concrete panels with 14± inch square driven concrete king piles spaced about 6 feet on-center, and a reinforced concrete cap, as seen in Photographs 1 through 6 below. In addition, for the first 20± feet north of the boat ramp, what appears to be a more recent precast concrete protective veil wall and associated concrete cap is located seaward of the original concrete panels and king piles, as seen in Photograph 3 below. No vertical joints were observed in the concrete cap.

A stormwater outfall is located near the northern end of the bulkhead, which is associated with the 30± inch stormwater pipeline shown above in Figure 9. The stormwater outfall is shown in Photograph 6.

A small bulkhead associated with the fish cleaning station is a continuation of the southern boat ramp wall, and consists of cast-in-place concrete slab atop a sand-cement bag revetment wall. The sand-cement bag revetment appears to be similar to sand-cement bag revetment present on the northern embankment slope of the Peter P. Cobb Memorial Bridge western abutment, as seen in Photographs 8 and 9.

The bulkhead is evaluated as being in **serious to critical condition**, and the following items were observed:

1. Severe cracking and spalling of the concrete cap, concrete panels, and driven concrete king piles, as shown in Photographs 1 through 6 below.

2. Shoaling in the marina basin that is possibly associated with the nearby stormwater outfall in the bulkhead, as shown in Photographs 6 and 7 below.

Photograph 1. *View from the north staging dock of severely cracked concrete cap and king piles.*

Photograph 2. *View of severe cracking and spalling in concrete king pile along the north staging dock.*

Photograph 3. *View of gap between protective concrete veil and original bulkhead.*

Photograph 4. *View of severe cracking and spalling in concrete panels, cap and king piles, facing northwest.*

Photograph 5. *View of severe cracking and spalling in the concrete cap.*

Photograph 6. *View of stormwater outfall and severe cracking and spalling in the adjacent concrete king pile, facing southwest.*

Photograph 7. *View of shoaling observed in marina basin, facing north.*

Photograph 8. *View of the cast-in-place concrete slab atop of a sand-cement bag revetment wall, facing south.*

Photograph 9. *View of similar sand-cement bag revetment on the northern embankment slope of the Peter P. Cobb Memorial Bridge western abutment, facing east.*

Area 1 – 125 Fisherman's Wharf

Figure 11. *125 Fisherman's Wharf parcel outlined in yellow.*

Background Information Obtained

Our search from the City of Fort Pierce Building Department yielded an As-Built Survey, dated May 20, 1986, which was prepared by James A. Kirby III, Registered Land Surveyor, and Boundary Surveys dated November 27, 2001 and April 30, 2004, which were prepared by Culpepper & Terpening, Inc. Copies of these surveys are included in Appendix II. Important items to note from the surveys include:

- The locations of 3 stormwater inlets along the bulkhead at 125 Fisherman's Wharf.
- The location of a former metal building located along the western property boundary of 125 Fisherman's Wharf.
- The locations of fuel tank fillers and a gas pump island associated with the previous gas station operations at 125 Fisherman's Wharf.
- The location of the former 2-story building located at 201 Fisherman's Wharf.

Our search from the DEP Information Portal yielded photographs of the site from August 1, 2002, which show a view of the bulkhead wall, facing north, and a view of the southern dock, facing east. These photographs are included for reference in Appendix II.

Site Observations

The 156± linear foot bulkhead appears to consist of precast concrete panels with 14± inch square driven concrete king piles spaced about 6 feet on-center and a reinforced concrete cap, as seen in Photographs 10 through 13 below. Additional 8-inch and 10-inch square driven concrete piles are located immediately adjacent to some of the king piles, as shown in Photographs 10 through 13 below. No vertical joints were observed in the concrete cap.

The bulkhead is evaluated as being in **serious to critical condition**, and the following items were observed:

1. Severe cracking and spalling of the concrete cap, concrete panels, driven concrete king piles, and the smaller additional driven concrete piles, as shown in Photographs 10 through 15 below.

2. Extremely severe cracking and spalling of the concrete cap, concrete panels, and driven concrete king piles, specifically in the general area of the truck loading ramp near the southern end of the parcel, as shown in Photographs 11 and 12 below.

3. Stormwater outfalls associated with the stormwater inlets reported and observed in pavement areas above, as shown in Photograph 13 below.

Photograph 10. *View of severe cracking and spalling in concrete cap, king piles and smaller additional driven piles.*

Photograph 11. *View of extremely severe cracking and spalling observed in truck loading area, facing northwest.*

Photograph 12. *Closer view of the extremely severe cracking and spalling observed in truck loading area.*

Photograph 13. *View of a large hole in the concrete panel above southern stormwater outfall, facing southwest.*

Photograph 14. *View from the parking/drive areas of cracking observed in concrete cap.*

Photograph 15. *View of severe cracking in a 10-inch concrete pile supporting the southern dock, facing north.*

Area 1 – 201 Fisherman's Wharf

Figure 12. *201 Fisherman's Wharf parcel outlined in yellow.*

Background Information Obtained

Our search from the City of Fort Pierce Building Department yielded building addition and remodeling plans for the 2-story building formerly located on the site, dated July 31, 1990, which was prepared by Robert E.A. Terry, Jr. – Architect. A copy of these plans is included for reference in Appendix II. In brief, these plans show the location of the proposed building addition foundations, and the proximity of the new foundations to the bulkhead.

In addition, documents obtained from the City of Fort Pierce Building Department associated with the demolition of the building between December, 2005 and January, 2006 are included for reference in Appendix II. We note that specific details from the demolition activities regarding the building foundations and any associated underground utilities are unknown.

Our search from the DEP Information Portal yielded photographs of the site from May 7, 1993, which show the concrete piles associated with dock, and from August 1, 2002, which show the location of the 2-story building in relation to the subject bulkhead. Select photographs are presented as Figures 13 and 14 below, and all photographs obtained from these dates are included for reference in Appendix II.

Figure 13. *May 7, 1993 photograph (by others) obtained from DEP Information Portal, showing square concrete piles associated with the previous dock and boat slips.*

Figure 14. *August 1, 2002 photograph (by others) obtained from DEP Information Portal, showing the location of the former 2-story building and square concrete piles associated with the previous dock.*

Site Observations

The 284± linear foot bulkhead appears to consist of precast concrete panels with a reinforced concrete cap and a presumed deadmen system, as seen in Photographs 16 through 22 below. No vertical joints were observed in the concrete cap. In addition, some of the 8-inch square concrete piles associated with the previous dock structure seen above in Figures 12 and 13 remain, as shown in Photographs 20 through 22 below.

The bulkhead is evaluated as being in **poor to serious condition**, and the following items were observed:

1. Major to severe cracking and spalling in the concrete cap and panels, as shown in Photographs 16 through 20 below.

2. Failures at joints between concrete panels, as shown in Photographs 19 and 20 below.

3. Various concrete debris from some of the remaining concrete piles that were associated with the previous dock, as shown in Photographs 21 and 22 below.

Photograph 16. *View of severe cracking in concrete cap, indicated with red arrows.*

Photograph 17. *View of severe cracking and spalling observed in concrete cap (cap continues to 219 Fisherman's Wharf), facing east.*

Photograph 18. *Closer View of severe cracking and spalling observed in concrete cap.*

Photograph 19. *View of joint failure between concrete panels, and severe cracking and spalling in concrete cap and panels.*

Photograph 20. *View of joint failure between concrete panels near Slip No. 14, facing northwest.*

Photograph 21. *View of severe cracking and spalling in concrete pile associated with previous dock.*

Photograph 22. *View of damaged concrete pile associated with previous dock.*

Area 2 – 219 Fisherman's Wharf

Figure 15. *219 Fisherman's Wharf parcel outlined in yellow.*

Background Information Obtained

Based on our review of the aerial photographs, the alignment of bulkhead at 219 Fisherman's Wharf changed between around 2007 and 2009, as shown in Figures 16 through 18 below.

Our search from the City of Fort Pierce Building Department yielded an inspection history summary report stating that the demolition of the previous bulkhead was completed on July 1, 2008. This document is included for reference in Appendix II.

In addition, a photograph obtained from the Florida Fish and Wildlife Conservation Commission (FWC) website for the Black Pearl Boat Ramp shows what appears to be demolition activities in-progress with a trackhoe, as shown in Figure 19 below.

Figure 16. *1992 aerial photograph showing the previous bulkhead alignment and former structures.*

Figure 17. *2006 aerial photograph showing the previous bulkhead alignment and former structures.*

Figure 18. *2011 aerial photograph showing the current bulkhead alignment and all previous structures removed.*

Figure 19. *Undated photograph (by others) obtained from the FWC website for the Black Pearl Boat Ramp, showing apparent demolition activities at 219 Fisherman's Wharf on the left-hand side of the photograph.*

Site Observations

The 63± linear foot bulkhead appears to consist of precast concrete panels with a reinforced concrete cap and a presumed deadmen system, as seen in Photographs 23 through 25 below. No vertical joints were observed in the concrete cap.

The bulkhead is evaluated as being in **poor condition**, and the following items were observed:

1. Severe cracking and spalling of the concrete cap, as shown in Photographs 23 through 25 below.

2. Underwater concrete debris located immediately south of the bulkhead, as shown in Photographs 23 and 24 below.

Photograph 23. *View of severe cracking and spalling in the concrete cap, facing north.*
Note, remnants of concrete piles associated with the previous dock at 201 Fisherman's Wharf are also visible.

Photograph 24. *View of underwater concrete debris, and severe cracking and spalling in the concrete cap and panels, facing north.*

Photograph 25. *View of severe cracking and spalling in the concrete cap and panels, facing east.*

Area 2 – 221 Fisherman's Wharf

Figure 20. *221 Fisherman's Wharf parcel outlined in yellow.*

Background Information Obtained

As previously mentioned, based on our review of the aerial photographs, the western end of the bulkhead changed around 2008, and buildings were previously located on the northwestern and southeastern corners of the property, as shown in Figures 16 through 18 above.

In addition, due to the open area created after the demolition of the building at the southeast corner of the parcel, the erosion of the upland soils over time can be observed on reproductions of the 2006, 2011 and 2016 aerial photographs, presented as Figure 21 below.

Our review of the Google *Streetview* and Bing *Streetside* on-line map tools of the area from March, 2015 yielded images of people apparently fishing while standing on top of both of the bulkheads. An example showing the eastern bulkhead is presented as Figure 22 below, and additional examples are shown in Appendix II.

Figure 21. *2006, 2011 and 2016 aerial photographs, showing continued erosion at the southeast corner of 221 Fisherman's Wharf.*

Figure 22. *Google Streetview from March, 2015, showing unauthorized fishing activities on top of the eastern bulkhead.*

Site Observations

The remaining 130± linear foot and 30± linear foot bulkheads appear to consist of precast concrete panels with a deadmen system and a reinforced concrete cap, as seen in Photographs 26 through 28 below. No vertical joints were observed in the remaining concrete caps.

In addition, an unusual gravity block wall consisting of large square concrete poles is located to the north of the remaining 30± foot bulkhead facing the Intracoastal Waterway (ICW), as seen in Photographs 29 through 32 below. We note that this is an odd structure, and we speculate that these concrete poles could have been placed during the original land reclamation activities and/or construction of the causeway bridge shown in the 1921 aerial photograph (Figure 4).

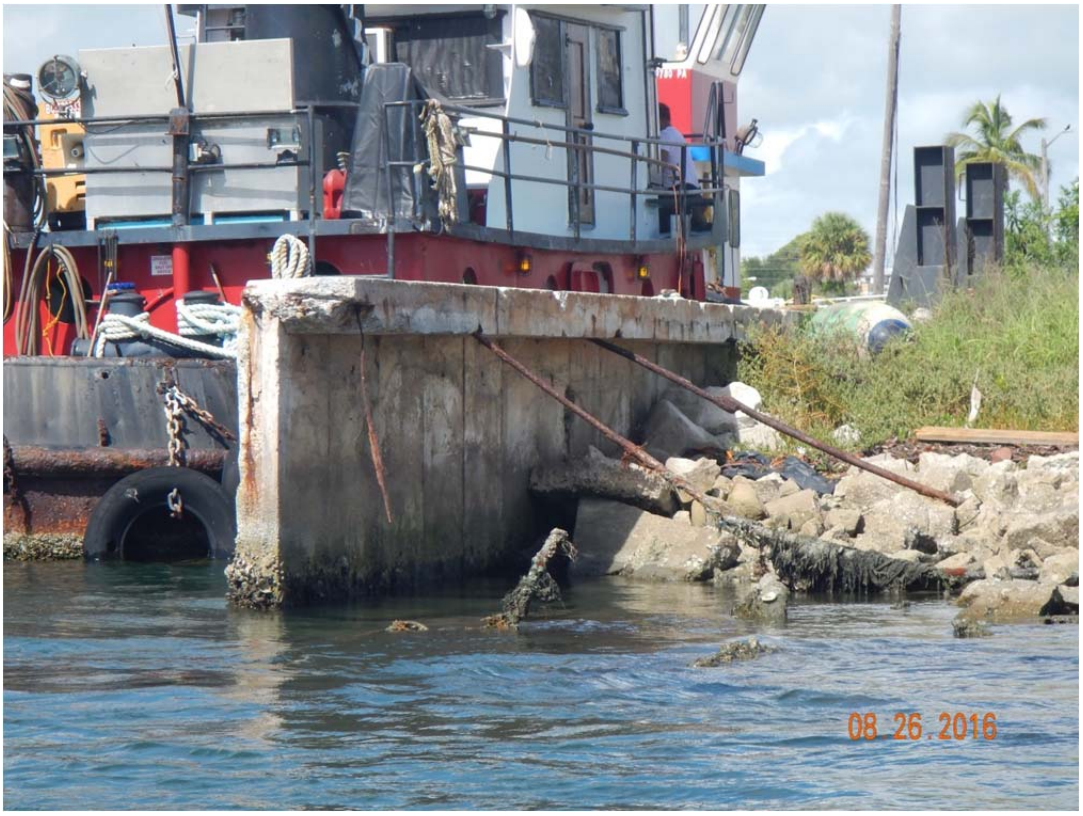
The bulkheads are evaluated as being in **critical condition**, and the following items were observed:

1. Severe cracking and spalling of the concrete cap and panels, as shown in Photograph 26 below.

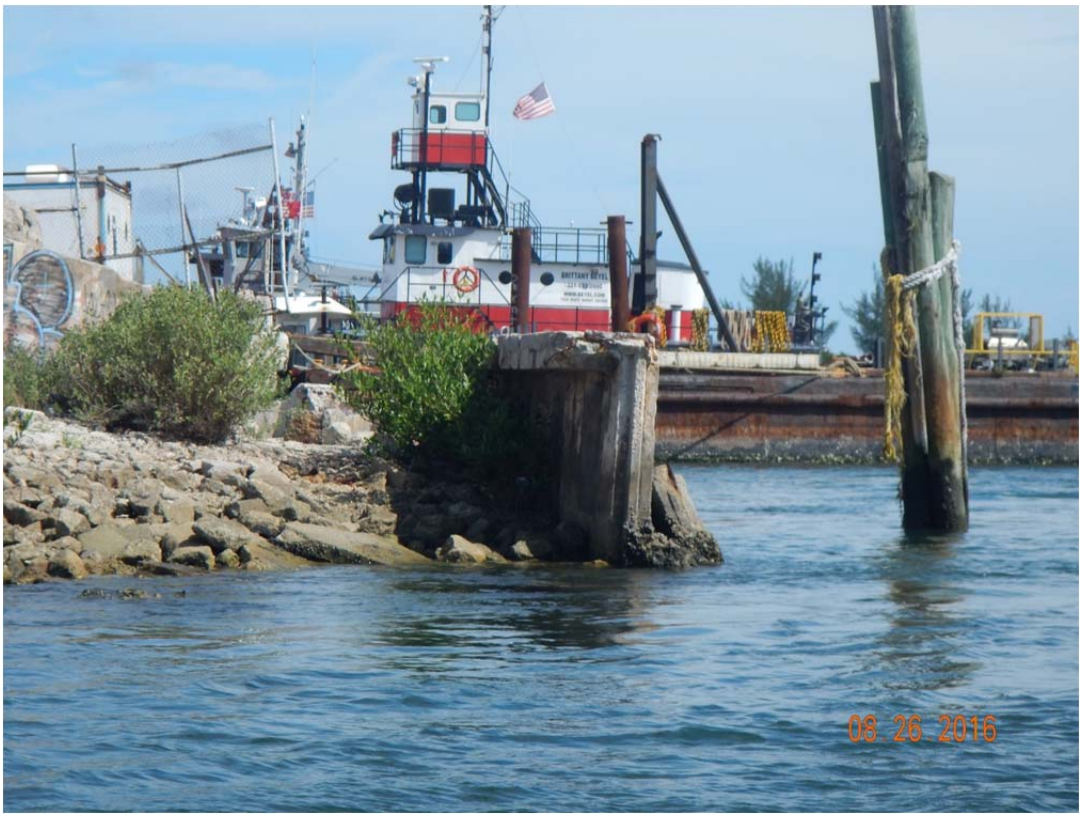
2. Severe deterioration to total decay of the exposed deadmen tie rods, and the absence of deadmen, as shown in Photographs 27 and 28 below.

3. After the Hurricane Matthew storm event between October 6 and 7, 2016, additional concrete debris resulting from the delamination of two of the concrete poles was observed, as shown in Photographs 29 through 32 below.

Photograph 26. *View of severe cracking and spalling in the concrete cap and panels, facing west.*



Photograph 27. *View of severe deterioration and total decay of the exposed deadmen tie rods, facing west.*



Photograph 28. *View of eastern bulkhead currently without deadmen or tie rods, facing north.*

Photograph 29. *View of the unusual concrete pole gravity block wall, July 15, 2016.*

Photograph 30. *View of the unusual concrete pole gravity block wall after Hurricane Matthew, October 10, 2016. New concrete debris from delamination circled in red.*

Photograph 31. *View of the unusual concrete pole gravity block wall, July 6, 2016.*

Photograph 32. *View of the unusual concrete pole gravity block wall after Hurricane Matthew, October 20, 2016. New concrete debris circled in red.*

Area 3 – Eastern Terminus of Fisherman's Wharf Roadway

Figure 23. *Eastern Terminus of Fisherman's Wharf roadway parcel outlined in yellow.*

Background Information Obtained

As previously mentioned, based on our review of the aerial photographs, the western end of the previous causeway to South Hutchinson Island was located at the eastern end of the Fisherman's Wharf roadway.

Our search from the DEP Information Portal yielded pages from a 2005 permit for a Fort Pierce Utilities Authority (FPUA) 16-inch water main (FDEP Permit No. 56-0190183-004), which presents the general location and depths of the 16-inch water main submarine crossing. Select pages from this document are included for reference in Appendix II.

We confirmed the presence of this FPUA submarine crossing with the Fort Pierce Utilities Authority Service Area Map, which was obtained on-line from the FPUA website and is included for reference in Appendix II. In addition, the general location of the submarine crossing is shown on the NOAA Nautical Chart No. 11475 (Fort Pierce Harbor), and is included for reference in Appendix II.

Site Observations

The 50± linear foot bulkhead appears to consist of steel sheet piles encased in cast-in-place concrete with a reinforced concrete cap, as seen in Photographs 33 through 36 below. The 10± linear foot bulkhead appears to be cast-in-place concrete, and resembles a wing wall of a bridge abutment, as seen in Photographs 37 through 39 below. No vertical joints were observed in the concrete cap.

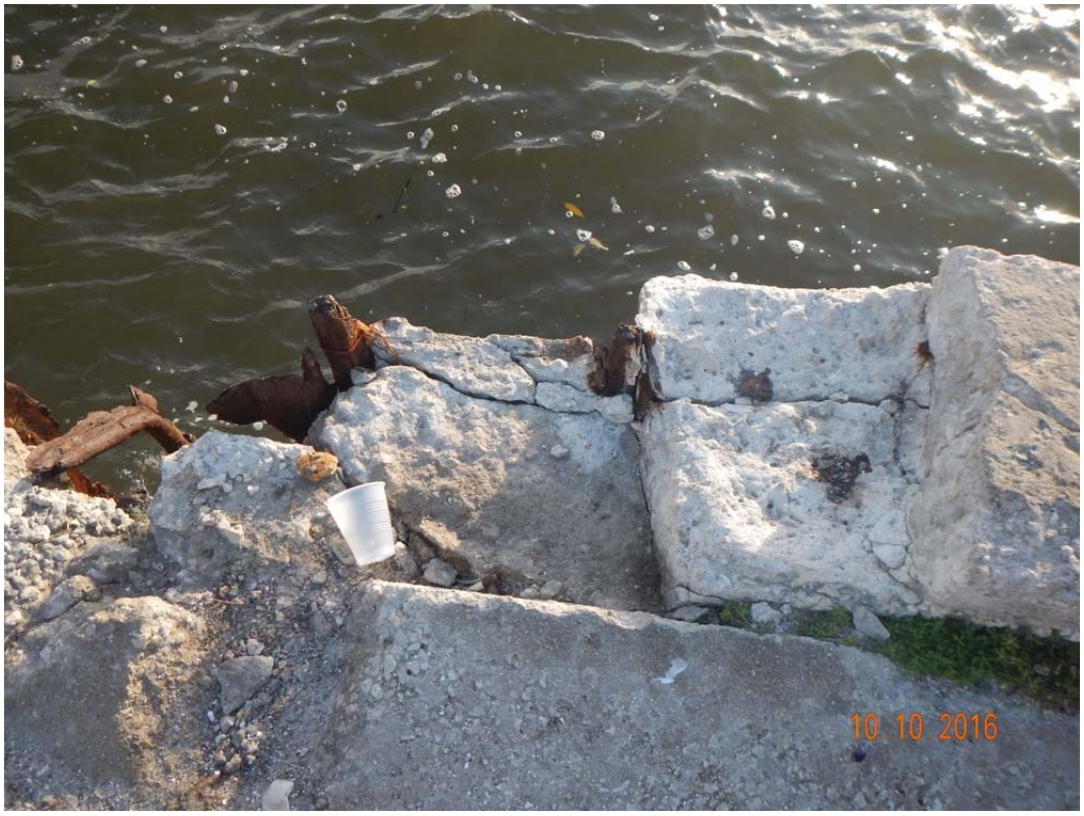
A large sign warning not to anchor or dredge because of a submarine BellSouth cable crossing is located on the southern side of the parcel. In addition, a FWC monofilament recycle bin is affixed to one of the wooden posts of the large sign, as shown in Photograph 40 below.

The bulkhead is evaluated as being in **serious to critical condition**, and the following items were observed:

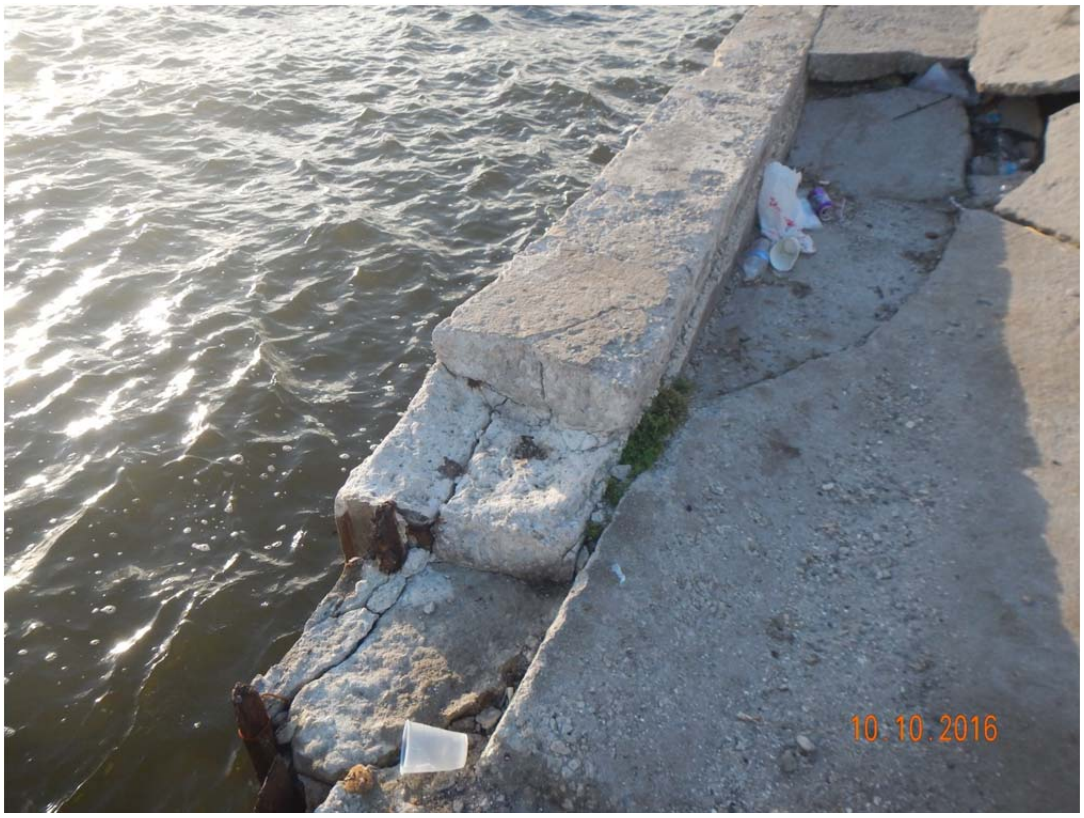
1. Severe deterioration to total decay of the steel sheet piles, as shown in Photographs 33 through 38 below.

2. Severe cracking and spalling of the concrete cap, as shown in Photographs 33 through 35 below.

Photograph 33. *View of decaying steel sheet piles encased in concrete, facing north.*



Photograph 34. *View of decaying steel sheet piles and severe cracking and spalling in the concrete cap.*



Photograph 35. *View of severe cracking and spalling in the concrete cap, facing south.*

Photograph 36. *View of unauthorized fishing activities at the bulkhead, facing west.*

Photograph 37. *View of the warning sign for a BellSouth submarine cable crossing, facing west.*

Photograph 38. *View of decaying steel sheet piles located at the southern end of the bulkhead.*

Photograph 39. *View of the southern end of the bulkhead, facing north.*

Photograph 40. *View of FWC Monofilament Recovery & Recycling Program bin (circled in red).*

Photograph 41. *View of FWC field officer vehicle (circled in red) patrolling the general area.*

Photograph 42. *View of concrete debris associated with the previous bridge and the loss of retained soils landward of the bulkhead, facing south.*

Photograph 43. *View of remnants of the concrete approach slab associated with the previous bridge, facing north.*

PRELIMINARY RECOMMENDATIONS

Based on our discussions and the information provided, it is our understanding that the subject bulkheads are being considered for repair or replacement in the near future. We further understand that future improvements under consideration for the Fisherman's Wharf Marina also include dredging the marina basin and widening the Black Pearl Boat Ramp located at 600 North Indian River Drive.

The following sections are specific for each subject parcel within the Fisherman's Wharf Marina, and present our preliminary recommendations that are based on our review of the background information obtained, our field observations, and judgement based on our experiences with similar projects.

600 North Indian River Drive – Serious to Critical Condition

Although the bulkhead to the north of the Black Pearl Boat Ramp remains in place, it appears to be well past its effective service life span, and in some places it appears to be approaching the end of its physical life span. In addition, the severe cracking observed in the concrete elements can further deteriorate, resulting in concrete spalling and additional debris in the marina basin.

The cracking and spalling of the concrete cap, panels and king piles located along the staging dock can present a safety hazard for boaters and their passengers wearing minimal foot protection.

The stormwater outfall located at the northern end of the property boundary appears to coincide with the shoaling observed in the marina basin. Consideration should be given to including a baffle box type of structure between the stormwater outfall and the drainage structures located on both sides of North Indian River Drive, in order to intercept sediment and debris from entering the marina basin.

125 Fisherman's Wharf – Serious to Critical Condition

Although the bulkhead remains in place, it appears to be well past its effective service life span, and in some places it appears to be approaching the end of its physical life span. Further, urgent consideration should be given for the repair and/or replacement of the bulkhead specifically in the area of the truck loading area and southern stormwater outfall. In addition, the severe cracking observed in the concrete elements can further deteriorate, resulting in concrete spalling and additional debris in the marina basin.

The pavement areas adjacent to the bulkhead also appeared to be in poor to very poor condition, and will likely require full pavement reconstruction. Consideration should be given to updating the stormwater drainage in concert with future pavement improvements to include baffle box type structures in order to intercept sediment and debris from entering the marina basin.

201 Fisherman's Wharf – <u>Poor to Serious Condition</u>

Although the bulkhead remains in place, it appears to be approaching the end of its service life span; however, without specific details of the demolition activities from late 2005 and early 2006 of the former 2-story building, the condition of any deadman system is unknown. Therefore, prior to developing the subject parcel, a thorough subsurface soil exploration, should be performed to identify the locations of the deadmen, and if any remaining foundations or previous underground utilities that were plugged with grout or concrete are in close proximity to the bulkhead or any of the deadmen.

The observed failures at the joints between concrete panels are of concern, and can be problematic because of loss of retained soils through the joint failures. In addition, the severe cracking observed in the concrete elements can further deteriorate, resulting in concrete spalling and additional debris in the marina basin.

219 Fisherman's Wharf – <u>Poor Condition</u>

Although the bulkhead remains in place, it appears to be well along in its service life span; however, without specific details from the 2008 demolition activities and subsequent design and construction plans of the bulkhead, the full condition of the bulkhead cannot be realistically evaluated with any degree of certainty.

221 Fisherman's Wharf – <u>Critical Condition</u>

Although portions of the bulkhead remain in place, it appears to be well past its effective service life span, and at some locations has reached the end of its physical life span. Further, the continued deterioration of the bulkhead elements will result in continued erosion of the upland soils and additional concrete debris into the marina basin and Intracoastal Waterway.

In addition, urgent consideration should be given for the repair and/or replacement of the bulkhead due to the safety hazard shown in the Google *Streetview* (Figure 22). This is very concerning, and corrective measures should be taken immediately to prohibit future occurrences.

Eastern Terminus of Fisherman's Wharf Roadway – <u>Serious to Critical Condition</u>

Although the bulkhead remains in place, it appears to be well past its effective service life span, and in some places it appears to be approaching the end of its physical life span.

The miscellaneous trash and concrete debris observed in the area can present a safety hazard for the general public, and should be removed and maintained. Further, the presence of a FWC Monofilament Recovery & Recycling Program bin implies that fishing and recreational activities are permitted in the area. In addition, consideration should be given to removing the monofilament recycling bin and taking other measures to discourage these activities until the area is suitable for public use.

CLOSURE

Our services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This company is not responsible for the conclusions, opinions or recommendations made by others based on the information presented herein. No other warranties are expressed or implied.

This preliminary condition assessment is only preliminary and is not an evaluation of structural capacity. The determination of such would necessitate a thorough structural analysis.

We appreciate the assistance you, the City of Fort Pierce, the St. Lucie County Regional History Center and the Florida Department of Transportation have provided us in this phase of the project. Please contact us if any questions arise, or if we may be of service in any way.

Respectfully,
Dredging & Marine Consultants, LLC

Will B. Cornelius II, P.E. 11-22-16
Geotechnical Engineer / Manager
Florida Registration No. 67538

Appendix I: Additional Site Photographs
Appendix II: Relevant Background Documents and Information