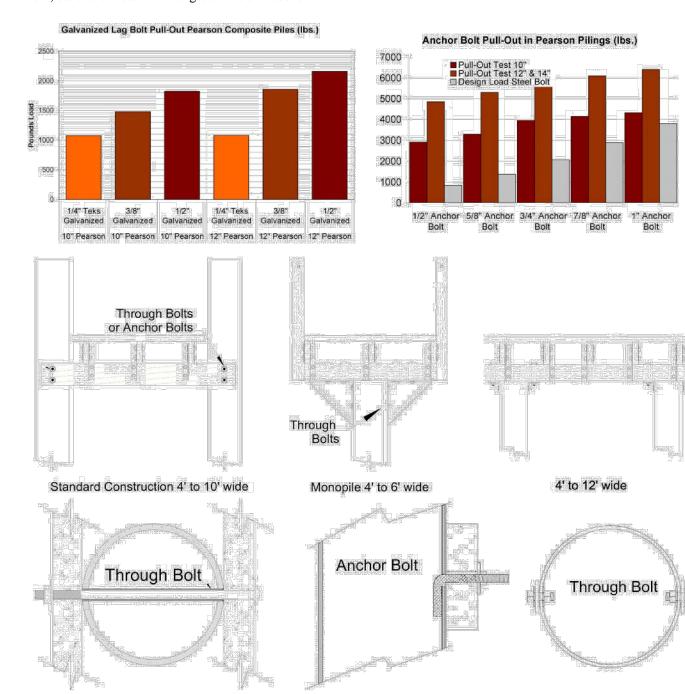




#### **Attachment and Assembly Data**

Due to the three dimensional fiber architecture of Pearson Pilings fiberglass reinforcements, through-bolts and anchor bolts are all used for various installations and applications. Even lag bolts can be used for non-structural fastening. The holding and pull-out strength of bolted connections to the composite pile typically exceed the operating load recommendations for galvanized bolts as shown below. Structural cross members, beams, boat lifts and ramp hardware should be attached using either anchor bolts or through bolts.

Lag bolts may be used for non-structural connections and fitting of cleats, line holders, hand rails, fenders, ladders, benches and lighting fixtures. 1/4" Washer Head Teks screws should be used for attaching pile caps – most self tapping screws will work, but avoid those with flanges on the drill section.



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# Driven to Last

# **Pearson Pilings Testing** Angle Bracket / 3/4" Bolts

In order to determine recommended loading for the use of galvanized brackets with a single 3/4" bolt, an axial load test was performed. To simplify the fixture, the 4" square brackets were attached to the end of a 10" diameter pile so that the flats were above the pile top by .250".



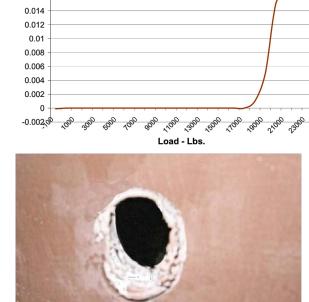
Assembled Brackets – 10" Pile



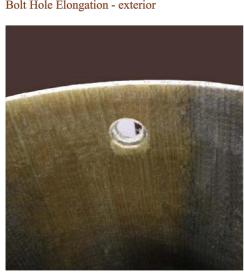
The load was applied in increments of 1,000 lbs. – there was a compressive deformation in the composite pile wall at 18,000 lbs. total load (9,000 lbs. per bracket).

The elongation in the pile wall did not propagate from 18,000 lbs. to 23,000 lbs. at which point the <sup>3</sup>/<sub>4</sub>" bolts started to deform. The test was discontinued at this point.

Angle Bracket Vertical Movement - Inches



Bolt Hole Elongation - exterior



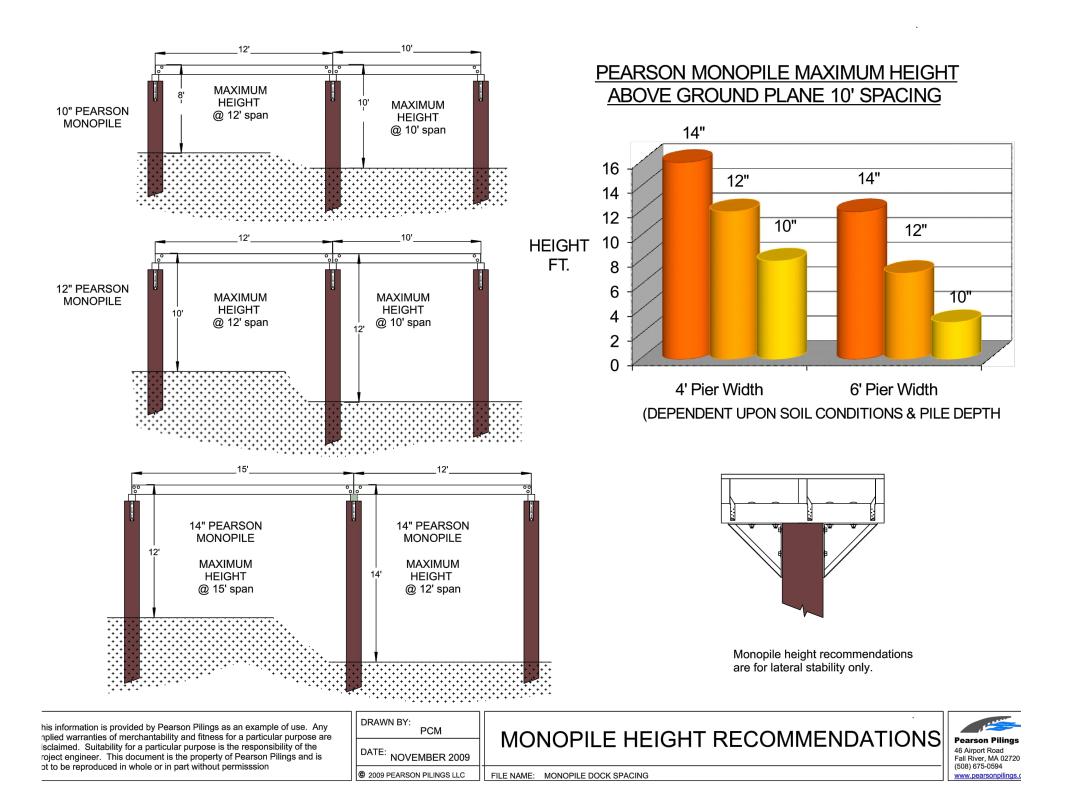
Bolt Hole Elongation - interior

Testing performed at the Kirk Laboratory, Civil Engineering Dept., University of Rhode Island © 2007 Pearson Pilings, LLC

The nominal working load of a 3/4" galvanized bolt is typically 4,400 lbs. and the yield of the composite pile wall (10" diameter) is 9,000 lbs. with a recommended capacity for bolt shear the same as the working load of the bolt.

### Q1. What kind of pile drivers have you used on Pearson Piles?

A1. We have used drop, impact (hydraulic, pneumatic, diesel) and vibratory hammers with a sheet pile clamp to drive the composite piles with no problems and little or no damage to the cosmetics. What does seem to work best with vibratory hammers is a sheet pile clamp that grips one edge of the pile. We usually insert a 1/4 section of a pile cut-off to reduce cosmetic damage, but even without it we only damage 8" of the top. Normally this is cut off when capping the piles. A pile clamp works well, but the clamp pressure needs to be reduced and a wood plug inserted into the composite pile. The top 3-to-4 feet will then be trimmed off.



# **Engineering Data – Pearson Composite Piles**



Materials Properties		Piling Diameter						
		8"	10"	12"	14"	16"		
Reinforcement	(grams/square meter)	2269	6072	7997	8329	10084		
A quasi-isotropic th	ree dimensional proprietary fa	abric utilizing e-g	glass grade filar	ments				
Exceptional damag	e tolerance with no crack prop	pagation						

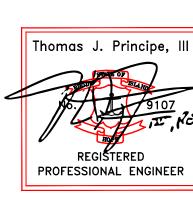
An epoxy / vinylester, with high elongation, low styrene monomer, excellent hydrolytic stability and high heat deflection temperature, will not leach, inert, high chemical resistance, insoluble in any common hydrocarbons, mild acidic or alkaline solutions

Mechanical Properties	Piling Diameter						
*Minimum Values*	8"	10"	12"	14"	16"		
Axial Tensile Strength - psi	50,122	50,490	68,000	66,890	64,300		
Axial Tensile Modulus - (MOE) - psi	4,547,780	3,530,000	4,030,000	4,100,000	3,960,000		
Axial Flexural Strength - psi	58,400	79,650	89,400	91,450	89,600		
Axial Compressive Strength - psi	43,320	67,000	76,800	77,460	74,800		
Transverse Tensile Strength - psi	11,733	29,000	27,600	28,700	28,400		
Transverse Tensile Modulus - psi	2,433,870	1,760,000	1,774,000	1,760,000	1,770,000		
Interlaminar Shear Strength - psi	13,000	12,000	12,000	12,000	12,000		
Effective Bending Stiffness - psi	1.190E+08	3.214E+08	9.333E+08	1.528E+09	2.507E+09		
Young's Modulus	4,547,780	3,530,000	4,030,000	4,100,000	3,960,000		
Poisson's Ratio	0.22	0.25	0.23	0.24	0.24		
Allowable Bending Moment - kips-ft (FS = 2)	16	19	56	69	101		
Allowable Axial Load - kips short column	100	210	280	515	800		
Barcol Hardness	>50	>50	>50	>50	>50		
Glass to Resin Ration - by weight	~60:40	~60:40	~60:40	~60:40	~60:40		
Aprox. Wall Thickness - inches	~.117	~0.250	~0.375	~0.375	~0.500		
Aprox. Weight - Ibs/ft	4	7	10	13	20		
Thermal Expansion - in/in/°F	<.00014	<.00012	<.000006	<.000006	<.000006		
Water Absorption - %	<.25	<.25	<.25	<.25	<.25		

For more information contact: Pearson Pilings, LLC 846 Airport Road Fall River, MA 02720 508-675-0594 www.pearsonpilings.com

\*Pearson Pilings does have the ability to customize laminates to meet the needs of your project should requirements exceed our standard piling specifications\*

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General Notes

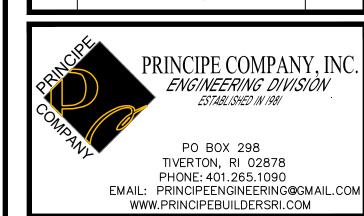
**DETAILS PROVIDED BY:** 

PEARSON PILINGS, LLC 846 AIRPORT ROAD FALL RIVER, MA 02720 PHONE: 508.675.0594





REMOVAL OF BOAT LIFT Revision/Issue



NEW DOCK PLANS AP 25 LOT 45 395 PARK AVENUE PORTSMOUTH, RHODE ISLAND

04/28/2023 2 OF 3

#### CRMC DOCK NOTES: (Section 300.4 - Recreational Boating Facilities)

- 1.) The Executive Director or the Deputy Director may only grant a variance for the extension of a recreational or limited recreational boating facility out to 75 feet beyond MLW or up to a 50% increase beyond the fifty (50) foot standard (Section 300.4.E.3.l) provided engineering, biological, and other appropriate concerns are met.
- 2.) All residential and limited recreational dock designs shall be in accordance with Table 3 Minimum Design Criteria, but in no case shall any structural member be designed to withstand less than 50 year storm frequency, including breaking wave conditions in accordance with ASCE 7 (current edition) and FEMA Manual 55. All design elements including the bathymetry shall be stamped by a Rhode Island registered Rhode Island Professional Engineer.
- 3.) Fixed structures which are for pedestrian access only shall be capable of supporting forty (40) pounds per square foot live load as well as their own dead weight; floating structures shall be capable of supporting a uniform twenty (20) pounds per square foot live load, or a concentrated load of four hundred (400) pounds. A written certification by the designer that the structure is designed to support the above design loads shall be included with the application.
- 4.) No creosote shall be applied to any portion of the structure.
- 5.) A residential or limited recreational boating facility shall be a maximum of four (4) feet wide, whether accessed by a fixed pier or float. The terminal float size shall not exceed one hundred fifty (150) square feet to be reviewed as a Category A application. A variance may be granted up to 200 square feet in excessive fetch areas, however this shall be reviewed as a Category B application at the full Council. In the absence of a terminal float, a residential boating facility may include a fixed terminal T or L section, no greater than four (4) by twenty (20) feet in size.
- 6.) All new or replacement floats shall utilize floatation that was specifically fabricated for marine use and warranted by its manufacturer for such use. Foam billets or foam bead shall not be utilized unless they are completely encapsulated within impact resistant plastic.
- 7.) Where possible, residential boating facilities shall avoid crossing coastal wetlands. In accordance with Section 300.17, those structures that propose to extend beyond the limit of emergent vegetative wetlands are considered residential boating facilities. Facilities shall be located along the shoreline so as to span the minimal amount of wetland possible. Facilities spanning wetlands shall be elevated a minimum of four (4) feet above the marsh substrate to the bottom of the stringers, or constructed at a 1:1 height to width ratio. Construction in a coastal wetland shall be accomplished by working out from completed sections. When pilings are placed within coastal wetlands, only the immediate area of piling penetration may be disturbed. Pilings should be spaced so as to minimize the amount of wetland disturbance. No construction equipment shall traverse the wetland while the facility is being built. 8.) Owners are required to maintain their facilities in good working condition. Facilities may not be abandoned. The owner shall remove from tidal waters and coastal features any structure or portions of structures which are destroyed in any natural or man-induced manner.
- 9.) Float ramps and other marine appurtenances or equipment shall not be stored on a coastal feature or any area designated as a CRMC buffer zone.
- 10.) The use of cribs for structural support shall be avoided. The use of cribs as support in tidal waters may be permitted given certain environmental design considerations. However, in these instances the size and square footage shall be minimized and the structure cannot pose a hazard to navigation. When cribs are permitted for structural support, they must be removed when the useful life of the structure has ceased (e.g. the structure is no longer used as a means of accessing tidal waters).
- 11.) Residential and limited recreational boating facilities shall not intrude into the area within twenty five (25) feet of an extension of abutting property lines unless (1) it is to be common structure for two or more adjoining owners, concurrently applying or (2) a letter or letters of no objection from the affected owner or owners are forwarded to the CRMC with the application. In the event that the applicant must seek a variance to this standard, the variance request must include a plan prepared by a RI registered Land Surveyor which depicts the relationship of the proposed facility to the effected property line(s) and their
- 12.) Residential and limited recreational boating facilities shall not extend beyond that point which is (1) 25% of the distance to the opposite shore (measured from mean low water), or (2) fifty (50) feet seaward of mean low water, whichever is the lesser.
- 13.) All residential and limited recreational docks, piers, and floats shall meet the setback policies and standards contained in municipal harbor management plans and/or harbor ordinances approved by the Council. However, in all cases, residential docks, piers, and floats shall be setback at least fifty (50) feet from approved mooring fields and three-times the U.S. Army Corps or Engineers authorized project depth from federal navigation projects (e.g., navigation channels and anchorage areas).
- 14.) The surface of the dock, pier and float shall be designed in a manner which provides safe traction and allows for the appropriate drainage of water.
- 15.) As part of a residential or limited recreational boating facility, the terminal float may be designed such that it facilitates the access of small vessels such as kayaks, dinghies, personal water craft, etc., onto the float, provided that all other programmatic requirements are met. Mechanical apparatus to accomplish this shall not exceed twenty four (24) inches in height from the top of the float.
- 16.) All residential and limited recreational docks shall have the centerline of the structure between its most seaward and most landward portion designated on the plans with State Plane Coordinates (NAD83). A WAAS enabled GPS system with an accuracy of  $\pm$  3 meters shall be considered acceptable. The Executive Director shall have the discretion to require greater accuracy.
- 17.) Lateral Access shall be provided under, around or over as appropriate for the site conditions at all new residential docks.
- 18.) All residential and limited recreational docks shall be certified by the Design Engineer that it was constructed according to the approved plans within typical marine construction standards. The Executive Director shall have the discretion to require AS-BUILT survey plans of residential and limited recreational docks that includes property lines.

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9/8/2023

COASTAL RESOURCES MANAGEMENT COUNCIL

#### E.3.1 Residential and Limited Recreational Docks with Excessive Fetch Standards

(a) A location shall be considered to have excessive fetch if there is a  $20^{\circ}$  sector over four miles in

any direction in which wind can blow over the water to generate waves. (a) Boat lifts, suitably designed and installed, are encouraged for docks with excessive fetch.

(b) Residential and limited recreational docks with excessive fetch shall provide uplift calculations as part of the required calculation package.

(c) All structural elements, including the boat lift, shall be designed to withstand the 100 year storm frequency, including breaking wave conditions in accordance with ASCE 7 (current edition) and

(d) All residential and limited recreational docks with excessive fetch shall have an As-built plan on file with the CRMC within thirty (30) days of construction that certifies conformance with the approved plans.

(e) All residential and limited recreational docks with excessive fetch shall be inspected and certified by a Registered Professional Engineer licensed in Rhode Island that all elements of the dock and lift system meet the requirements of ASCE 7 (current edition) or FEMA Manual 55 every five (5)

Min Pile Cut Off

Steel or cast steel

Aluminum alloys

normal weight)

Asphalt paving

Concrete, reinforced

Concrete, reinforced

V zone elevation + float

45 – 60 pcf 145 – 155 pcf

90-120 pcf

#### **DESIGN CRITERIA PER TABLE 3**

- Min. Pile Tip diameter 10"
- Min. Pile But diameter 12"
- Residential Minimum Pile embedment 10 feet
- Residential Deck load 40 psf LL / 400 lb concentrated - Min Float Freeboard - 12"
- \*including LL and DL
- Design Wind Loads wind gust based on 50 year return and natural period of 60 seconds
- Wave Conditions (min) All fixed and floating structure shall be designed for a 3'
- Min / Max Float freeboard 8" / 30"
- Minimum Stringer/Joist 3"x10"
- Minimum through bolt Hardware Diameter <sup>3</sup>/<sub>4</sub>" hot dipped galvanized
- Minimum Cross bracing 3"x10" - Minimum lag bolt diameter - ½"
- Minimum Water depth at the
- terminus of recreational boating facilities 18" MLW
- Required Datum MLW

# BREAKING WAVE LOAD ON VERTICAL PILE CALCULATION

 $F = \frac{1}{2} C \gamma D H^2 = \frac{1}{2} (1.75)(64 \text{ lb/ft}^3)(1 \text{ ft})(13.26 \text{ ft})^2 = \frac{1}{2} (19,693) = 9,846 \text{ lb}$ 

M = 9,846 lb (17 ft) = 167,388 ft-lb / 5 piles = 33,477 ft-lb

- F = drag force acting at the stillwater elevation
- C = breaking wave coefficient (1.75 for round piles)
- $\gamma$  = specific weight of salt water (64 lb/ft<sup>3</sup>)
- D = pile diameter
- H = breaking wave height at design stillwater depth (H = 0.78(17 ft) = 13.26 ft)
- M = moment applied by breaking wave load

# HYDRODYNAMIC LOAD ON VERTICAL PILE CALCULATION

 $F = \frac{1}{2} C_0 V^2 A = \frac{1}{2} (1.2)(1.99 \text{ slug/ft}^3)(17 \text{ ft/s})^2 (17 \text{ ft}^2) = \frac{1}{2} (11,732) = 5,866 \text{ lb}$ 

# M = 5,866 lb (8.5 ft) = 49,862 ft-lb / 5 piles = 9,972 ft-lb

F = hydrodynamic load acting at mid-depth C = drag coefficient (1.2 for round piles)

 $\rho = \text{density of salt water } (1.99 \text{ slug/ft}^3)$ 

A = surface area of pile normal to flow

V = velocity of water (V = ds/t = 17ft / 1sec = 17 ft/s)

M = moment applied by hydrodynamic load

# DEBRIS IMPACT LOAD ON VERTICAL PILE CALCULATION

F = W V CD CB Cstr = (1,000 lb)(11.7 ft/s)(1.0)(1.0)(0.2) = 2,340 lb

M = 2,340 lb (17 ft) = 39,780 ft-lb / 5 piles = 7,956 ft-lb

- F = debris impact load in pounds
- W = weight of the object (recommended 1,000 lb weight)
- CD = depth coefficient (1.0 = for > 5 ft depth)
- CB = blockage coefficient (1.0 = for no upstream screening) $C_{str} = structure coefficient (0.2)$
- V = velocity of water  $(V=1/2(g ds)^1/2 = 1/2(23.4) = 11.7 ft/s)$

M = moment applied by debris impact load

# MAXIMUM BENDING MOMENT

Mmax = 33,477 + 9,972 + 7,956 = 51,405 ft-lb = 51.4 kip-ft < 56 kip O.K.

# VERTICAL UPLIFT FORCE ON PIER DECK

 $F = \gamma h L W = (64 lb/ft^3)(7.25 ft)(10 ft)(4 ft) = 18,560 lb$ 

F = vertical uplift force per pile from wave slam on pier deck

 $\gamma$  = specific weight of salt water (64 lb/ft<sup>3</sup>)

h = height of wave above pier deck (h = 17 ft - 9.75 ft = 7.25 ft)

L = length of pier between piles (10 ft per design) W = width of pier deck (4 ft per design)

# **BUOYANCY UPLIFT FORCE PER PILE**

 $F = \gamma \text{ (vol.)} = (64 \text{ lb/ft}^3)(13.4 \text{ FT}^3) = 860 \text{ lb}$ 

F = upward buoyancy force per pile

 $\gamma$  = specific weight of salt water (64 lb/ft<sup>3</sup>) vol. = volume of each pile (vol. = 17 ft x  $(\pi (0.5)^2)$  = 13.4 ft<sup>3</sup>)

# **MAXIMUM UPLIFT FORCE**

Fmax = 18,560 + 860 = 19,420 lb < 25,000 lb O.K.

NOTE: Pile driver to establish a minimum resistance of 25,000 lb per pile according to above uplift calculations. All work to be coordinated with engineer.

#### NOTES:

#### HOOP PILE HOLDER

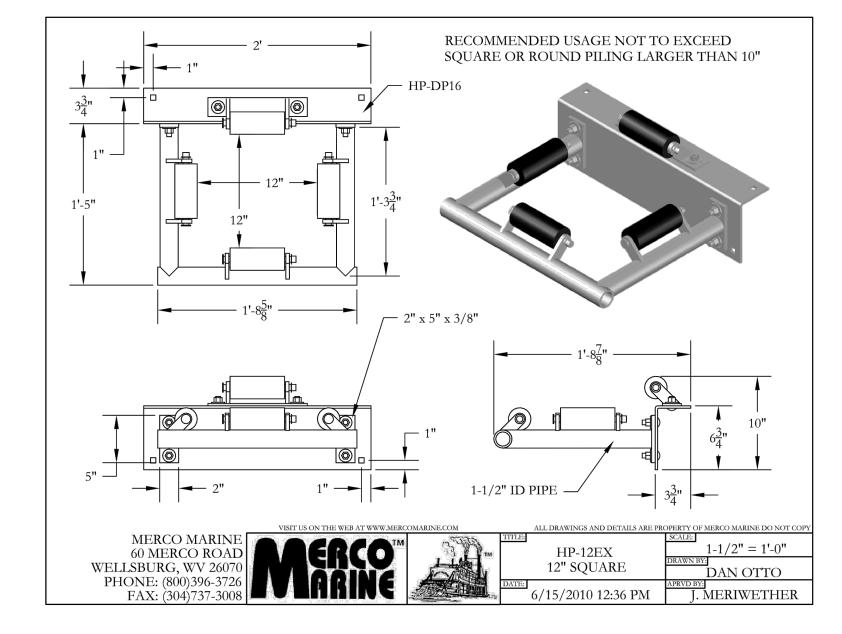
MOUNTING FRAME SHALL BE MADE FROM 1/4" MILD STEEL AND HOOP MADE FROM 1 1/2" SCHEDULE .40 STEEL PIPE. ALL MATERIALS ARE TO BE HOT-DIPPED GALVANIZED AFTER ALL WELDING AND FABRICATION IS COMPLETE. MOUNTING FRAMES SHALL USE 3/4" GALVANIZED CARRIAGE BOLTS FOR ATTACHMENT TO THE DOCK. HOOPS ARE TO BE ATTACHED TO THE MOUNTING BRACKET WITH 3/4" STAINLESS STEEL HEX HEAD BOLTS AND NYLOCK NUTS. THE ROLLER IS TO BE FABRICATED OF RUBBER. THE HOOP PILE HOLDER SHALL BE FOLLANSBEE SERIES PH-H OR

#### FLOAT DRUMS

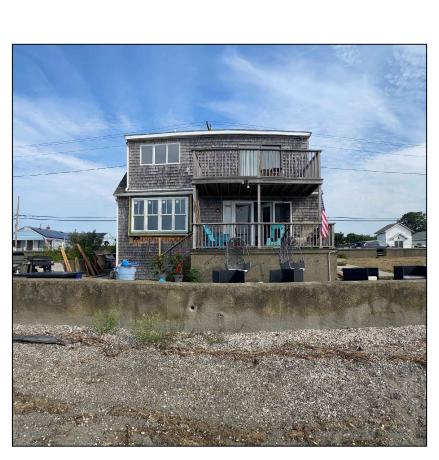
THE FLOAT DRUMS SHALL HAVE A HIGH DENSITY POLYSTHLENE (HDPE) SHELL FILLED WITH HIGH QUALITY EXPANDED POLYSTYRENE (EPS). EACH DRUM SHALL HAVE A 3" MOUNTING FLANGE MOLDED AROUND THE ENTIRE PERIMETER. A MINIMUM OF EIGHT (8) 1/2" LAG BOLTS WITH FLAT WASHERS SHALL BE USED TO ATTACH THE DRUMS TO THE DOCKS FRAMING ALL FLOAT DRUMS SHALL MEET STATE AND FEDERAL REQUIREMENTS FOR POSITIVE FLOTATION AND SHALL BE COAST GUARD APPROVED. THE FLOAT DRUMS SHALL BE FOLLANSBEE SERIES THREE FLOAT DRUM OR

#### FLOATING DOCK HARDWARE

ALL FOUR OUTSIDE CORNERS SHALL HAVE OUTSIDE CORNER ENDS AND INSIDE CORNER HARDWARE. ALL HARDWARE SHALL BE HOT-DIPPED GALVANIZED 1/4" HIGH STRENGTH CARBON STEEL. ALL HARDWARE SHALL BE ATTACHED USING 3/4" GALVANIZED BOLTS WITH NYLON LOCK NUTS.



# SITE PHOTOS



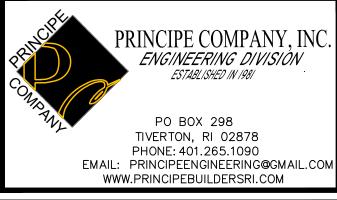




LOOKING WEST



Thomas J. Principe, III PROFESSIONAL ENGINEER **DETAILS PROVIDED BY:** PEARSON PILINGS, LLC 846 AIRPORT ROAD FALL RIVER, MA 02720 PHONE: 508.675.0594 **Pearson Pilings** REMOVAL OF BOAT LIFT Revision/Issue PRINCIPE COMPANY, INC. ENGINEERING DIVISION ESTABLISHED IN 1981 PO BOX 298 TIVERTON, RI 02878 PHONE: 401.265.1090 EMAIL: PRINCIPEENGINEERING@GMAIL.COM WWW.PRINCIPEBUILDERSRI.COM



NEW DOCK PLANS

AP 25 LOT 45 395 PARK AVENUE PORTSMOUTH, RHODE ISLAND

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LOOKING SOUTH

