

02000 – FLOATING DOCKAGE SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work covered in this section consists of furnishing all labor, materials, equipment and supplies, necessary to completely manufacture and install the Floating Dockage Systems as shown on the drawings and as specified herein.
- B. The work shall include, but shall not be limited to, furnishing and installing the following:
 - 1. All dock and walkways, including decking, bumpers, cleats, utility channels, access ramp, hinge connections, and marine hardware.
 - 2. All utility systems, electrical/telecommunications, sanitary, and water, indicated on the drawings.
 - 3. All piles and anchorage systems required.
 - 4. All dock utility pedestals.
- C. The work shall provide an integrated system conforming to the configuration shown on the drawings, serviceable to the intended use, and as detailed on the drawings and specified, herein.
- D. All work shall meet the most stringent (local, State of Illinois, or Federal) applicable codes.

1.02 BASIS OF PAYMENT

- A. Floating Dockage System shall be paid at the General Contractor's bid price per lump sum to furnish and install a complete system, including, but not limited to, cleats, fender and support piles, walkways, piers, fishing piers, fuel dock, gangways, utility pedestals (including electrical wiring and potable water piping within the pedestal), fire centers, anchorage with all associated marine hardware, and the following dock utility systems:
 - 1. Water Distribution System, including all pipe, valves, fittings, and service connections to the utility pedestals (including connection and plumbing within the pedestal). This item shall also include all disinfection and testing necessary to place the potable water distribution system in service.
 - 2. Sanitary Pumpout System, including all pumps, all pipe from the hydrants to the pumps (both on land and dock-mounted), valves, fittings, hose reels (1 per central pumpout system), and service connections to the dock-mounted hydrants. This item shall also include all testing necessary to place the sanitary pumpout system in service.
 - 3. Ice Suppression System, including air compressors, enclosures, distribution piping, aeration tubing, and all necessary mounting appurtenances to install the permanent ice suppression system as proposed in Section 02010 Ice Suppression System.

4. Electrical System, including all cable, conduits (as needed for electrical and telecommunications facilities), dock and land-based distribution equipment, utility pedestals (including electrical wiring within the pedestal), and electrical service to pedestals, lights, pumpout, and ice suppression equipment.
5. Fuel System, including all fuel dispensers, control kiosk, fuel lines, monitoring and telecommunication system mounted on the Fuel Dock, is not included with payment for the Floating Dockage System. Payment for dock-mounted fuel system components and appurtenances shall be included with the remainder of the Fuel System under Section 15190 – Fueling Station.

1.03 DEFINITIONS

- A. Access Ramp - See Gangway
- B. Channel - A main waterway for boats entering a harbor or for traveling from one area to another.
- C. Deck Planks – Main structural members attached to dock substructure to create a walking surface.
- D. Depth - The depth of water below a defined datum plane, such as low water datum.
- E. End Cover – Non-structural member that is attached to conceal open end of plank.
- F. Fairway - A maneuvering waterway for boats leaving or entering slips.
- G. Fender Pile – Pile driven within double-loaded slips to prevent excessive boat movement and to provide an additional mooring point.
- H. Fill Strip – Non-structural members that are snapped down into planks to conceal screws.
- I. Freeboard - The distance between the water level and the top of the deck of a floating or fixed structure.
- J. Gangway - A structure, which provides pedestrian access between a fixed pier or shore and a dock walkway. This is usually hinged at the fixed end and provided with supports at the walkway end.
- K. Guide Pile – Driven pile for anchoring floating dock structures. Guide Piles are attached to the dock by means of pile guides which fix the floating docks in position while allowing freedom of movement vertically. Guide Piles extend above the high water mark to accommodate fluctuations in water elevation.
- L. Low Water Datum (LWD) – A statistically derived benchmark elevation corresponding to typical low water levels in a water body. This elevation has been determined by the United States Army Corps of Engineers for Lake Michigan as 577.50 ILGD85 = 0 LWD.
- M. Ordinary High Water Mark (OHWM) – A benchmark elevation corresponding to high water levels in a water body during normal years. This can be observed as the upper elevation on the shore or bank of a water body which exhibits regular presence of water. This elevation

has been determined by the United States Army Corps of Engineers for Lake Michigan as 581.50 ILGD85 = + 4' LWD.

- N. Public Landing - A structure to be used by transient or home based boats for the purpose of loading and unloading passengers or supplies.
- O. Significant Wave Height: Amplitude of waves, measured in feet corresponding to the average of the upper 1/3 of recorded wave heights for a particular design storm. This value is used as a means of quantifying the wave agitation within a harbor for use in structural design of coastal and harbor structures.
- P. Skirting – Non-structural member attached to rim joists concealing deck substructure.
- Q. Slip - One berthing space with provisions for access from the shore.
- R. Stake Piles – Steel Piling driven into the marina basin for anchoring floating docks. Stake piles are cut off near the bottom of the marina basin to allow for attachment to anchor chains.
- S. Walkways - A structure either floating or fixed providing pedestrian access to slips.
 - 1. Finger Walkway - One alongside a slip.
 - 2. Header Walkway - One that is perpendicular and provides direct access to finger walkways.
 - 3. Main Walkway/Main Pier – A pier providing access to a number of header walkways from shore or a marginal walkway.
 - 4. Marginal Walkway/Marginal Pier - One parallel and adjacent to the shoreline.

1.04 QUALIFICATIONS AND EXPERIENCE

- A. Floating Dockage System shall be manufactured by a firm with a minimum experience of ten (10) years in design, constructing, and installation units conforming to these specifications.
- B. Substitutions items will be handled in accordance with Section 13.06 of Book 2 of the Contract Documents.
- C. The manufacturer shall maintain a service department and a stock of spare parts, able to respond and be delivered within 48 hours, for emergency repair or replacement of dock components.

1.05 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. Steel and Steel Fasteners
 - a) ASTM A36 – 08: Standard Specification for Carbon Structural Steel
 - b) ASTM A123 – 09: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

- c) ASTM A153 – 09: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- d) ASTM A242 - 04(2009): Standard Specification for High-Strength Low-Alloy Structural Steel
- e) ASTM A252 - 98(2007): Standard Specification for Welded and Seamless Steel Pipe Piles
- f) ASTM A307 - 07b: Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- g) ASTM A325 - 09a Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- h) ASTM A370 - 09ae1: Standard Test Methods and Definitions for Mechanical Testing of Steel Products
- i) ASTM A413 – 07: Standard Specification for Carbon Steel Chain
- j) ASTM A563 - 07a: Standard Specification for Carbons and Alloy Steel Nuts
- k) ASTM A653 – 09: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- l) ASTM B695 - 04(2009) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
- m) ASTM C272 - 01(2007) Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
- n) ASTM F593 - 02(2008) - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- o) ASTM F594 - 08 Standard Specification for Stainless Steel Nuts
- p) ASTM F1941 – 07: Standard Specification for Electrodeposited Coatings on Threaded Fasteners
- q) ASTM F2329 – 05: Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

2. Aluminum

- a) ASTM B209 – 07: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- b) ASTM B221 – 08: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- c) ASTM B429 – 06: Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

3. Miscellaneous

- a) ASTM C39 - 05e2: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- b) ASTM C138 - 09: Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

- c) ASTM C150 – 09: Standard Specification for Portland Cement
- d) ASTM C231 - 09a Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- e) ASTM C272 - 01(2007) Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
- f) ASTM C595 / C595M - 09 Standard Specification for Blended Hydraulic Cements

B. American Wood Preservers Association (AWPA)

- 1. U1-09: Use Category System: User Specification for Treated Wood

1.06 SUBMITTALS

A. General

- 1. General - The bidder shall provide four (4) sets of the submittals electronically, in accordance with Section 01450 Submittals and the requirements of the Parks Board of Chicago's CW system.

B. Shop Drawings and Submittals

- 1. Prior to manufacture or delivery to the project site, the manufacturer shall submit a complete set of manufacturer's shop drawings including a complete and dimensioned layout drawing, for all main piers, marginal piers, finger and tee piers, fishing piers and fuel dock. Fabrication drawings shall provide cross sections, attachments, connections, anchorage location and details, structural calculations, and other necessary information for adequate product analysis of the dock system and its components.
- 2. Shop drawings shall include specific details related to the location and arrangement of the dock utilities within the floating dock structure, and include a detailed list of materials scheduled for use.
- 3. Shop Drawings shall include detailed connection drawings, water and sewer plumbing schematics, electrical schematics, shown in plan and cross section view for all pier sizes.
- 4. Shop drawings shall include mounting details for all permanent dock-mounted equipment, including but not limited to rub rails, ADA fishing pier railings, sanitary hydrants, utility pedestals, cleats, fire centers, electrical transformers/enclosures, and connection details related to these items.
- 5. A comprehensive dock signage plan shall be submitted to ensure all piers and slips are provided with signage in accordance with this specification.

C. Certifications

- 1. To determine the conformance of the manufacturers' dock system with the drawings and the material requirements of these specifications, the CONTRACTOR shall supply to the CR the following certifications prior to manufacturing the dock system.

- a) Decking Certification: CONTRACTOR shall be responsible for having decking material certified in accordance with the applicable APWA Usage Class Standards (Wood) or ASTM Strength Requirements (Composite Decking or Concrete Decking).
 - b) Metal Products Certification: CONTRACTOR shall provide notarized certification of all aluminum, iron, and steel materials utilized in the manufacture and installation of the dock system. This certification must attest to the compliance of all structural members, fasteners, welds, and piling with the appropriate ASTM Reference Standards, indicated in Paragraph 1.05 of this specification.
 - c) Engineering: The CONTRACTOR shall supply complete structural calculations to accompany the shop drawings and submittals. These structural calculations shall include system anchorage, structural design, and flotation. All structural calculations shall bear the signature and seal of a State of Illinois licensed professional engineer. The engineer providing the structural certification and calculations shall have a minimum of 10 years experience as a professional engineer specializing in marina-waterfront engineering.
 - d) Welding Certifications: The manufacturer shall provide a list of American Welders Society (AWS) Certified welders to be employed in the fabrication and joining of the dock system. This list shall include the welder's name, AWS certifications, and relevant experience. Welders working on site shall produce their certifications to the CR upon request.
2. Storm Preparation Plan: The manufacturer shall detail a plan for preparing the dockage system and moored vessels within the marina for large scale storm events. This plan shall be limited to those procedures which can be rapidly undertaken by operations staff to prevent or limit damage to the dockage system during large storm events. The requirements of this plan are further detailed in Article 3.03.B.
 3. Warranty Certification: Manufacturers of products and materials to be incorporated by the Dock Manufacturer shall certify the warranty for their respective products as shown in the plans, shop drawings and included in the work.

1.07 INSPECTION

- A. General: As a matter of Quality Control in accordance with Section 01400 Quality Control Procedures and Product Standards, test sections of each pier type shall be fabricated and made available for inspection by the CR and their representatives. If approved, test sections may be incorporated in the work.

Rejected sections may be corrected and incorporated in the work, provided the properties of the reworked section are identical to that of a correctly fabricated section. Reworked sections shall be visibly and functionally identical to that of virgin materials and correctly fabricated sections. Each reworked section shall be identified with corrective action noted and subject to a final inspection by the CR prior to acceptance.

- B. Scope of Inspection:

1. Dock System: Inspection of the test sections shall be a visual inspection to evaluate the fabricated dock section, including dock structure, anchorage connections, dock connections (bolted and welded), decking materials and construction and connection of flotation.

2. Flotation pontoons: 3 - Flotation pontoons shall be selected for cross-sectional analysis during the initial inspection and again on site prior to installation of the docks, for a total of 6 pontoons. The pontoons shall be identified at random the CR. The manufacturer shall remove and cross section these pontoons for visual evaluation and measurement for conformance with these specifications. The evaluations shall be made by the CR.
 3. Further Inspection: The CR reserves the right to inspect and test all components and systems incorporated in the Floating Dockage System at any time during fabrication, following delivery and during installation for compliance with the plans and these specifications.
- C. Test Sections: The manufacturer shall fabricate and make available for inspection, the following items of work:
1. Main Walkway/Pier Section: Any Width
 - a) Approximately 40 feet in length per each
 2. Finger Pier: 1-50' Finger pier
 3. Floating Dock Access Gangways: See Section 02005 – Floating Dock Access Gangways
- D. Corrective Action: Notifications of any deficiencies, corrections or alterations and all subsequent corrective action shall be in accordance with Section 01400 Quality Control Procedures and Product Standards.

PART 2 - MATERIALS

2.01 DOCK SYSTEMS

- A. Products: Dock Systems may be selected from one of the following:
1. Meeco System as manufactured by Atlantic-Meeco, Inc. Contact: Atlantic-Meeco, Inc, 1501 East Electric Avenue, McAlester, Oklahoma 74501, Phone (800) 627-4621, Fax (918) 423-3215
 2. Galva-Foam as manufactured by the Galva-Foam Division of ShoreMaster. Contact: ShoreMaster, 1025 International Drive, Fergus Falls, MN 56538, Phone (800) 328-8945, Fax (218) 739-4008
 3. Series 200 as Manufactured by Technomarine Manufacturing, Inc. Contact: Technomarine USA, Inc., 721 US Highway One, Suite 101 North Palm Beach, FL 33408, Phone (561)840-7738, Fax (561) 840-7748

2.02 DECKING

- A. Southern Yellow Pine
1. General:

- a) Lumber shall be 2"x 6" No. 1 Southern Yellow Pine, with 3/8 inch radiused edge, capable of stringer spans to 24 inches. The lumber shall conform to the rules of the Southern Pine Inspection Bureau. Lumber shall be dried to the moisture content as per association rules.
 - b) Lumber shall be subjected to certificate inspection conducted to regrade the decking material after treatment. This shall include inspection for those defects subject to developing during the treatment process, such as warping or splitting.
2. Treatment:
- a) Timber and lumber shall be pressure treated in accordance with American Wood Protection Association (AWPA) Use Category UC4C as is appropriate for Northern Freshwater Marine Environments. Lumber cut or drilled after treatment shall receive two heavy coats of the preservative on exposed surfaces in conformance with American Wood Preserves Association (AWPA) UC4C, C18.
 - b) Preservative (MCA/MCQ Micro Pro) shall have a retention by assay of treated wood of 0.24 pounds per cubic foot for MCA and 0.6 pounds per cubic foot for MCQ.
 - c) A paraffin based water repellent shall be included with the treatment phase to increase the water repellency and dimensional stability of the decking material
3. Moisture Content: Lumber shall be kiln-dried after the treatment phase (KDAT) to achieve proper moisture content, 19% maximum.
4. Material Storage and Handling
- a) Lumber shall be stored in a covered outdoor location, elevated off the ground and stacked to allow adequate air circulation.
 - b) Lumber shall be delivered to the dock assembly site and allowed to acclimate for a minimum of 14 days prior to installation on the dock. During this time, the wood shall be handled and stored in accordance with AWPA recommendations to allow thorough acclimation of the decking material to the temperature and relative humidity.
5. Fasteners:
- a) All deck fasteners shall be tamper-resistant TORX® head deck screws compatible with the preservative specified with a minimum length of 2.5 inches.
 - b) All fasteners must be hot-dip galvanized steel screws in accordance with ASTM A123 or mechanically galvanized in accordance with ASTM B695.
 - c) Deck screws shall be coated with a multi-layer baked-on corrosion protection system. The corrosion protection shall meet or exceed 2000 HR salt fog testing in accordance with ASTM F1137.
 - d) Deck fasteners shall be pre-drilled and countersunk. Installation shall be flush with a maximum recess of 1/8 inch. Protruding fasteners above the deck surface will not be accepted.
6. Spacing:
- a) Side-to-Side Spacing: 0 – 1/8 inch as installed (1/16 – 1/4 inch after 2 years)

- b) End-to-End Spacing: 0 – 1/16 inch as installed (0 – 1/8 inch after 2 years)
- c) Spacing of decking boards shall be determined at the time of installation, and should allow for the moisture condition of the wood as well as variations in temperature and humidity between the installed conditions and the anticipated in-place conditions. The installer shall follow Southern Pine Council and manufacturer's recommendations for spacing of decking material.
- d) Anticipated Climactic Conditions for Chicago Illinois
 - I) Temperature Range: -50°F – 114°F
 - II) Humidity Exposure: Severe

B. Grooved Decking

- 1. General: Where grooved decking has been specified, grooves shall be milled into tread surface a depth of 0.25 inches in a direction parallel to the length of the board. Grooved

2.03 DOCK STRUCTURE

A. Structural Steel

- 1. General:
 - a) Structural and miscellaneous steel shall meet the requirements of ASTM A36, with minimum yield strength of 36 ksi.
 - b) All steel shall be zinc-coated (hot dipped) in accordance with ASTM A123. See the Corrosion Protection portion of this spec for more information.
 - c) Structure shall be truss-type frame. No underwater truss type systems shall be permitted.
- 2. Welding: All welding shall be performed by qualified welders, in accordance with the American Welding Society (AWS) requirements. Welder's shall carry their certifications with them at all times while working on the project, and shall produce their certifications for the COMMISSION or the CR upon request.
- 3. Corrosion Protection:
 - a) All steel members shall be galvanized in accordance with ASTM A123. The minimum zinc coating thickness shall be 2.0 oz per square foot.
 - b) All members shall be hot-dip galvanized after drilling, welding, and fabrication operations have been completed.
 - c) All holes for the attachment of cleats, pile guides, Utility Pedestals, etc shall be installed prior to the galvanizing process. Any holes, cuts, or perforations occurring after galvanizing shall be repaired with high zinc content paint or a cold galvanizing process.

B. Aluminum

1. General:
 - a) Aluminum shall be marine-grade 5000 or 6000 series alloys.
 - b) Structure shall be fully extruded frame with fully-boxed stingers attached to lateral and cross-bracing.
2. Welding: All welding shall be performed by qualified welders, in accordance with the American Welding Society (AWS) requirements. Welder's shall carry their certifications with them at all times while working on the project, and shall produce their certifications for the COMMISSION or the CR upon request.
3. Corrosion Protection: Marine Grade aluminum alloy shall be suitable for an exposed marine environment.

2.04 STRUCTURAL FASTENERS & MOUNTING HARDWARE

A. General:

1. All structural connections shall be bolted.
2. Deck-mounted equipment may be mounted by screws or bolts.

B. Materials:

1. Steel: Steel fasteners shall conform to ASTM A307. High strength bolts shall conform to ASTM A325.
2. Corrosion Protection:
 - a) Galvanized Fasteners: Shall be hot-dipped galvanized in accordance with ASTM A153 and ASTM F2329.
 - b) Stainless Steel Screws: Shall conform to FF-S-111-D-3.2.
 - c) Coated Fasteners: Shall be coated with a multi-layer baked-on corrosion protection system. The corrosion protection shall meet or exceed 2000 HR salt fog testing in accordance with ASTM F1137.

C. Bolt Requirements: All bolts shall be provided with flat washers and nylon locking inserts. To prevent galling of nut and bolt, stainless steel nuts shall not be permitted.

D. Nuts: Nuts shall conform to the requirements of ASTM A-563 and shall be zinc-coated in accordance with ASTM F-1941. The grade of the nuts shall be compatible with the specified grade of bolt, and structurally adequate for the intended loading. All nuts shall be of a single grade to prevent misplacement.

E. Screws: Unless specified otherwise, fasteners for deck-mounted equipment or appurtenances shall be tamper-resistant TORX® head deck screws compatible with the specified wood preservative. Mounting hardware shall meet recommendations of the equipment manufacturer

for type and quantity. Hardware materials shall be compatible with the materials and coatings utilized by the equipment manufacturer.

2.05 FLOTATION UNITS

A. pontoons:

1. One piece, six sided, rotationally molded from medium or high-density polyethylene, Marlex, Dowlex or Union Carbide.
2. Minimum wall thickness shall be 0.150 inches. Wall thickness shall be uniform with no thinning in corners.
3. pontoons and substructure to act as one integral unit. pontoons shall be molded with adequate connection points to allow mounting to the dock structure. No drilling or perforation of the pontoon shall be permitted.

B. Foam:

1. Closed-Cell Expanded Polystyrene (EPS) manufactured with virgin polystyrene beads.
2. Extruded foam shall have a minimum density of 0.90 PCF and be closed cell with water absorption less than 3.0 lbs/cft at 7 days, when tested in accordance with ASTM C272.

C. Warranty

1. The system shall be warranted by the manufacturer against defective materials and workmanship for a period of 10 (ten) years.

2.06 ANCHORAGE AND MOORING SYSTEMS

A. Chain and Anchor System - For Main, Header and Finger Piers with Slips less than 50' in length. (Excluding Pier A)

1. General:

- a) Anchorage points shall be properly equipped with sufficient catenary curvature to be self-adjusting between + 5 and -2 feet from Low Water Datum elevation.
- b) Hawseholes shall be easily accessed for additional manual anchor chain adjustment as necessary to achieve a range of water elevations from +8 to -3 feet from Low Water Datum.
- c) Anchors utilized for this project shall be newly driven pile, helical anchors, or spud piles. Spud piles shall be permitted on fishing piers and boat launch piers where anchorage may coincide with the side slope of the breakwater.
- d) Concrete deadmen anchors shall not be permitted.
- e) It shall be the sole function of the anchor to restrain the dock from horizontal motion while allowing the dock to adjust vertically to changing water elevations. No attachment to other structures, such as sheet pile walls, will be permitted.
- f) The manufacturer shall provide structural calculations to certify adequate structural strength of piles/anchors, anchor rode (chain) attachments, anchor rode (chain), chain

guide on dock, bolt attachment between dock and chain guide, and the loading of the dock structure due to anchorage.

2. Materials

- a) Anchor Rode/Chain: The chain shall be high-strength, zinc-plated Grade 70 Transport Chain, welded steel chain manufactured suitable for Marine use. The chain shall be appropriately sized in accordance with the signed and sealed shop drawings,
- b) Chain Brackets: The dock-mounted chain brackets shall be integral with the structural dock chassis and shall be adequately sized for all anticipated loads in accordance with the signed and sealed shop drawings.
- c) Anchors:
 - I) Driven Piling: Driven Piling shall conform to the specifications set forth herein for Guide Pile and Fender Pile.
 - II) Helical Anchors:
 - a. Central Shaft: The central shaft of all Helical Anchors shall be Rounded-Corner Square (RCS) steel bar or Round Shaft Steel Tube meeting the following specifications.
 - i. Square Shaft Anchors shall be manufactured using rounded-corner square steel sections conforming with ASTM A29 or
 - ii. Round Shaft Anchors shall be manufactured using steel tube sections conforming to ASTM A500 or A513.
 - b. Helical Bearing Plate: The helical bearing plate shall be hot-rolled carbon steel sheet conforming to ASTM A572, ASTM A1018, or ASTM A656 with a minimum Yield Strength of 50 ksi.
 - c. Plates, Shapes, Caps, and Other Appurtenances shall be fabricated from structural steel in conformance with ASTM A36 or ASTM A572 Grade 50.
 - d. Corrosion Protection: All helical anchors shall be hot-dip galvanized in accordance with ASTM A123 or ASTM A153 after fabrication.
 - III) The dock manufacturer shall provide detailed drawings and calculations demonstrating the structural adequacy of the proposed anchors. The calculations shall be signed and sealed by a professional structural engineer, licensed in the State of Illinois meeting the qualifications and experience requirements defined in Paragraphs 1.04.A and 1.06.C.1.

B. Guide Piles and Fender Piles - For Pier A, Fuel Dock, and Main, Header and Finger Piers with Slips 50' in length and longer

1. General:

- a) Pile material shall be new and of uniform quality and shall conform to the following specifications.
- b) The steel pipe used for piles shall be seamless or electrically welded pipe conforming to ASTM 252-Grade 2. Minimum wall thickness shall be 0.300" unless otherwise indicated. Four copies of certified mill test reports covering the chemical and

physical tests conducted on the steel shall be furnished for each heat number of metal included in the shipment.

2. Pile Guides

- a) Pile Guides: Shall be designed to allow full vertical movement of the dock and shall minimize any damage to the dock or piling caused by movement throughout the range of anticipated water elevations, +8 to -3 LWD.
- b) At finger piers and where broadside mooring is possible adjacent to main, header, or marginal walkways, guide piles shall be internal to the dockage structure.

C. Combination Systems – For Boat Launch Piers and Fishing Piers

1. The dock manufacturer shall design anchorage for these structures consisting of a combination of Chain and Anchor in combination with Spud or Guide piles as previously specified.
2. The dock manufacturer shall closely examine existing field conditions and coordinate their proposed anchorage system for compatibility with the work performed by the coastal contractor. This shall include selection of the anchorage system, placement and scheduling of installation.

2.07 PILE ACCESSORIES

A. Coverings:

1. Materials:

- a) All fender pile shall be fully encased with High Density Polyethylene (HDPE) around the entire circumference. Encasement shall extend from the top of pile to -4' LWD. The encasement shall be a once piece, cast as a tube.
- b) All guide pile for dock anchorage shall be fully encased with Xylethon Ultra High Molecular Weight (UHMW) polymer around the entire circumference. Encasement shall extend from the top of pile to -6' LWD. The encasement shall be a once piece, cast as a tube. Seams shall be oriented to prevent contact with pile guide rollers.
- c) Encasement shall be specifically engineered as a marine covering with a textured surface free from markings or pipe class indications. Pipe materials will not be accepted.
- d) Color shall be black.

2. Dimensions

- a) Inside diameter shall be no more than 1/2" greater than the outside diameter of the pile.
- b) Thickness shall be a minimum of 0.08" for heat-shrinking sleeves and 1/4" for formed sleeves.

3. Fastening:

- a) Heat shrinking type coverings shall be self-anchoring when shrunk to guide piles per manufacturer's recommendations.

- b) Formed sleeves anchored to the piling with self-tapping screws in 316 Stainless Steel. 4 Screws shall be evenly spaced around the circumference of the pile at vertical intervals not to exceed 48 inches. Screws shall be recessed or countersunk flush with the covering material and located so as to prevent damage to moored boats.

B. Mooring Cleats: See Paragraph 2.08 Mooring Cleats

C. Pile Caps

1. Materials:

- a) Pile caps shall be one-piece circular cone-shaped High Density Polyethylene (HDPE) pile caps designed to fit over the pile and pile covering.
- b) HDPE pile caps shall be 1/8" thick.
- c) Color shall be black.

2. Fastening: Pile caps shall be fastened per manufacturer's recommendations.

2.08 SKIRTING AND FENDERING

A. Skirting:

1. General

- a) Floating Piers: exposed structural framework and flotation devices shall be skirted from decking to the bottom of the steel truss.

2. Materials:

a) General:

- I) The materials used for dock skirting shall be 2 x 8 inch nominal boards matching the decking material in accordance with Paragraph 2.01 of this specification.
- II) The skirting must be adequately secured full depth to the frame members with bolts or other acceptable fasteners as dictated by sound Engineering practices to prevent skirting and frame damage by ice, wave and impact design forces.

B. Fenders

1. General: Fenders shall be continuous horizontal Royalite 390A mounted on 2 x 8 inch Treated Southern Yellow Pine. Fenders shall be continuous over the entire main pier and finger pier sides. Fenders shall be white or grey in color, as selected by the OWNER. Once selected, the color shall be consistent for the entire facility. Fender construction shall be Heavy-Duty, non-marring, manufactured expressly for use in commercial marine dock applications. Vertical Wooden Strake-Type Fenders are not allowed.

2. Fasteners:

- a) Fasteners shall be 304 or 316 Stainless Steel staples or decking screws to prevent staining.

- b) Fasteners shall be installed at 4 inches on center. Installation shall be countersunk flush with fender to prevent injury or damage to boats.

2.09 MOORING CLEATS

A. Cleat Type and Material

1. All Mooring cleats shall be “S” Shaped.
2. All parts of cleats should be smooth with large radius.
3. Cleats shall be manufactured utilizing a heavy duty Almag 35 Alloy, 319 or 356 Marine Grade Aluminum Alloys.
4. Cleat Material shall be rated for minimum 27,000 psi tensile and 18,000 psi.

B. Cleat Placement

1. For double or single-loaded slips 45’ and less, a total of four (4) 12-inch (nominal) mooring cleats shall be provided. Three cleats shall be equally spaced broadside on the finger pier and one (1) mooring cleat shall be provided on the header pier.
2. For double or single-loaded slips 50’ and larger, a total of six (6) 15-inch (nominal) mooring cleats shall be provided. Four (4) cleats shall be equally spaced broadside on the finger pier, one (1) mooring cleat shall be provided on the header pier, and a single cleat (one cleat per slip, two per pile) attached to the vertically to the fender pile at +6’ LWD.
3. For single loaded slips, cleat placement on header pier shall be a single cleat centered on the midline of the slip. Cleat placement for single-loaded finger piers shall be consistent with adjacent double loaded finger piers.
4. For Tee and Finger piers loaded on one side only, cleats are required on the side of the pier directly adjacent to the moored vessel. Cleat placement shall be consistent with adjacent finger piers of the same length.
5. For Broadside Mooring, cleats shall be placed at 30 foot intervals along the fuel dock and all piers where broadside mooring can be anticipated.

C. Attachment

1. Cleats to be secured to the deck structural framing or steel piling with through bolts. Bolts shall be structurally adequate to achieve the full design strength of the Cleat without failure. Bolts shall be recessed to prevent chaffing. Cleats shall be through bolted to the main outer structural member as dimensioned in the plans. Cleats shall be placed in a location where tightening of the bolts and nuts holding cleats are as easy as possible.

2.10 UTILITY ACCESS

A. General

1. Utilities will be provided on all main, marginal, and header walkways to provide adequate space, access and separation for critical utilities as follows:
 - a) Potable Water Service to Each Slip
 - b) Sanitary Pumpout Service to Each Slip 50 feet and over.
 - D) In slip pumpout services by hydrants spaced at $\pm 50'$ and portable hose reel.
 - c) Electrical and Telecommunications Service to each slip.
2. Utility Channels: For docks utilizing utility channels, those channels will be of adequate size to accommodate potable water, sanitary pumpout, electrical, and all telecommunication utility piping and conduits.
3. Truss Installation: Utilities installed within the truss shall be installed in a consistent location on all docks. All pipes and cables shall be run straight, without unnecessary bends or fittings. Pipes and cables shall be provided with adequate slack and additional length to accommodate the dock movement.
4. Gangway Installation: Pipes and cables shall be provided with flexible connections and adequate slack within the gangway utility raceway to allow articulation of the gangway within the specified range without impingement of the utility line or generating axial stresses/strains.
5. Separation: To prevent contamination, potable water and Sanitary Lines shall maintain the greatest amount of physical separation possible. Where possible, they shall be installed within separate utility channels

B. Access

1. General:
 - a) Inspection, operation, and maintenance of all valves, flexible connections and drains on the utility lines can be performed from the top of the dock without the need to remove decking. Access to these fittings shall be provided by means of access hatches.
 - b) The cover shall be of marine grade aluminum with non-slip surface.
2. Access Hatches
 - a) All valves and components not accessible within a utility channel shall be equipped with access hatches.
 - b) All access hatches shall be embossed with a clearly legible legend to identify the utility contained within the access hatch.
 - c) Hatches shall be secured in the closed position by 304 or 316 stainless steel screws. Screw heads shall be tamper-resistant to prevent unauthorized access to the utility space.

2.11 UTILITY CABLES

A. General

1. All electrical wiring below deck shall be Type G Cable for marine use per Section 16820 Marina Wires and Cables. All other cables and wiring shall be enclosed within conduits which clearly identify the utility being carried.
2. Coaxial Cable for Telecommunication shall be as follows.
 - a) Main Feeds: All main coaxial cable feeds from land to the telecommunications side of the dock-mounted distribution panels shall be RG-11 cable.
 - b) Pedestal Feeds: A single, dedicated coaxial cable shall be run to each service port on the utility pedestal (2 per pedestal.). All coaxial cable from the distribution panel to each utility pedestal shall be RG-11/U.
3. Location of Cables
 - a) All cable shall be run within the dock raceway and bundled by means of cable ties without the use of conduit.

2.12 DOCK UTILITY PEDESTALS AND LIGHTING

A. General

1. Utility pedestals shall provide connections to electrical service, potable water, and other landside utilities as described in these Specifications and as shown on the Plans.
2. Utility pedestals, shall be rated as an entire assembly and shall comply with the requirements of ANSI/UL 231, NFPA 303 latest edition, and the applicable sections of NEC/NFPA 70 Paragraph 406.8.B.2.a.
3. Installation to be in accordance with local codes and approved by local electrical inspector.

B. Products

1. Utility Pedestals shall be new, manufactured by: Eaton Corporation – Marina Power and Lighting, 149 Warwick Court, Williamsburg, VA 23185, Phone: (800) 723-8009. Pedestal Models, at locations shown on the plans, shall be as follows:
 - a) Lighthouse Model
 - b) Power Point
2. Light Bollards shall be new, manufactured by: Eaton Corporation – Marina Power and Lighting, 149 Warwick Court, Williamsburg, VA 23185, Phone: (800) 723-8009. Pedestal Models, at locations shown on the plans, shall be as follows:
 - a) Mariner Model (White)

C. Construction

1. Housing: The housing shall be constructed of 1/4" thick injection molded resin material and shall be coated with UV-resistant polyurethane. It shall be UL listed as a type 3R weatherproof enclosure.
2. Wiring
 - a) The power pedestal shall be completely pre-wired at the factory to the load side of compression lug assembly.
 - b) All load copper wiring shall be of high stranding and tin-plated to resist corrosion.
 - c) The maximum size of the line wiring shall be # 2/0 AWG direct feed or #1 loop feed without stainless steel pedestal.
 - d) The maximum size of the line wiring shall be 350 MCM direct feed or #4/0 AWG loop feed with stainless steel pedestal.
3. Loop Feed Bus Bar System:
 - a) If no stainless steel pedestal base is utilized, the bus system shall be a 1/4" – 20 silicon-bronze stud with a silicon-bronze Belleville type washer. The 1/4" – 20 silicon-bronze hex-nut shall be torqued to 100 inch-pounds.
 - b) If a stainless steel pedestal base is utilized, the bus system shall be a 3/8" – 16 silicon-bronze stud with a silicon-bronze Belleville type washer. The 3/8" – 16 silicon-bronze hex-nut shall be torqued to 200 inch-pounds.
 - c) Double Barrel Mechanical Lugs (Optional) — rated for copper and aluminum are available.
4. Grounding: All exposed metallic parts must have integral ground that is a part of the equipment grounding system.
5. Receptacles
 - a) General:
 - I) All receptacles shall be of the corrosion resistant type, conform to NEMA L – 5 and/or NEMA L – 6 requirements and are rated for marine use. 100 ampere receptacles should conform to IEC and CEE standards.
 - II) All receptacles shall be mounted at an angle that is minimum 35 degrees from vertical and located behind a lockable weatherproof-hinged door that is under tension to ensure proper closing pressure when receptacle is or not in use.
 - III) All receptacles shall be mounted at least 24" above the dock.
 - b) Receptacle Requirements: Receptacle quantity and amperage shall be in accordance with the following table.

I) Table of Receptacles by Pier and Slip Type

PIER	SLIP TYPE	RECEPTACLES PER PEDESTAL		
		208V 1Ø 30-Amp	208V 1Ø 50-Amp	208V 1Ø 100-Amp
Pier A –B	35' Double-Loaded	4 (2 per side)		
	35' Broadside	2 (2 per side)		
Pier C –F	35' Double-Loaded	4 (2 per side)		
	75' Broadside	2 (1 per side)	2 (1 per side)	
Pier G	50' Double-loaded		2 (1 per side)	
	105' Broadside	2 (1 per side)	2 (1 per side)	
Pier H	50' Double-Loaded		2 (1 per side)	
	105' Broadside	2 (1 per side)	2 (1 per side)	
Pier I	50' Double-Loaded		2 (1 per side)	
	60' Double-Loaded		4 (2 per side)	
	115' Broadside		4 (2 per side)	
Pier J	60' Double-Loaded		4 (2 per side)	
	60' Broadside		2 (2 per side)	
Pier K	60' Double-Loaded		4 (2 per side)	
	70' Double-Loaded		4 (2 per side)	
	65-70' Broadside		2 (2 per side)	
Pier L	70' Double-Loaded		4 (2 per side)	
	70' Broadside		2 (2 per side)	
	71 – 150' Broadside	2 (1 per side)	2 (1 per side)	
	Superyacht Mooring		2 (2 per side)	1 (1 per side)

6. Circuit Breakers

- a) All breakers for receptacles shall be of the thermal-magnetic type, 10,000 AIC, and shall be UL listed.
- b) Circuit breakers for the receptacles shall be covered with the same lockable door that covers the receptacles.

D. Equipment

1. Base: The base shall be stainless steel and bolted to the utility pedestal.
2. Receptacles: Receptacles for boat users shall be a locking and grounding type, with Voltage, Phase, and Amperage as specified in the tables above.
3. Lighting:
 - a) Each light bollard and pedestal shall be equipped with non-metered light. The light shall be a 13-watt fluorescent biaxial light that is controlled by an electromechanical photocell. Lenses shall be amber in color.
 - b) All piers shall be tied in to a single photocell located on land adjacent to dock electrical distribution equipment and positioned to provide an unobstructed view of the sky.

- c) The lighting shall not interfere with boaters' navigation.
- 4. Circuit Breakers
 - a) Circuit breakers for 30 amp receptacles shall be a single-pole, 125 volt, 30 amp thermo-magnetic type.
 - b) Circuit breakers for 50 amp receptacles shall be a single-pole 125 volt 50 amp or two-pole 125/250 volt, 50 amp thermomagnetic type.
- 5. Metering: The pedestal shall be equipped with one fully electronic meter that displays the kilowatt-hours used by the pedestal on a non-resettable digital counter that is protected from the weather. The accuracy of the meter must be certified by the manufacturer to have a 125 ampere rating and no more than a 2% error when tested in accordance with an ANSI-C121.1.
- 6. Telephone and Cable TV: Each pedestal shall be equipped with one outlet per slip. Each outlet shall contain a marine telephone locking receptacle and a male cable TV connector under a weatherproof cover.
- 7. Water
 - a) The water connection shall be two (2) 3/4" inlets feeding two (2) 3/4" hose bibs. The valves shall be 1/4 turn ball valves.
 - b) Each service line shall be equipped with a backflow preventer as specified in Paragraph 2.13.E. The valves shall be 1/4 turn ball valves.
- 8. Power Pedestals for A.D.A. Slips (Designated as Handicap Accessible): Power pedestals installed on designated handicap accessible slips shall comply with the guidelines of the Americans with Disabilities Act of 1990 and the Access Board ADA Accessibility Guidelines for Recreational Facilities (2002).

2.13 POTABLE WATER

A. General

- 1. The pipe and all fittings shall be certified for potable water service in accordance with National Sanitation Foundation Standard 14.
- 2. The minimum allowable residual water pressure shall be 20 psi.

B. Pipe Materials

- 1. General: All piping and accessories shall be new and unused. Materials shall conform to the respective specifications and other requirements described below.
- 2. Water Mains: Copper Tube Water Main shall be hard tempered, samples copper tubing conforming to ASTM B88 and Federal Specification WW-T-799 (Latest Edition). Manufacturer's name or trademark and type of tubing shall be indented or otherwise identified at 3 feet intervals.

- a) In all cases where copper pipe connections are made to piping or an item of equipment of a dissimilar metal, provide dielectric fittings pipe and fittings with water works brass valves and hose bib connections.
3. Water Services: A water service, either 3/4" or 1" rigid copper as called for in the plans, shall be supplied from the main to each hosebib. Each service shall be supplied with a 1/4 –turn ball valve and backflow preventer meeting the requirements specified in Paragraph 2.13.C of this specification section. The ball valve shall be installed between the water main and the backflow preventer to facilitate maintenance. All water service valves and fittings shall be water works brass. The hosebib and operating valve shall be supplied with the Utility Pedestal as specified in Paragraph 2.12 of this specification section.

C. Flexible Hose:

1. General: Flexible hose shall be food-grade corrugated nitrile designed for pressure or suction applications. The hose shall be sized per the plans.
2. Product: Flexible hose shall be Saniflex SW432 Food Grade Flexible Nitrile Hose by Titan Industries, 11121 Garfield Avenue, South Gate, CA, 90280, Phone 1-800-862-1922.

D. Pipe Hangers:

1. All pipe hangers shall be UL listed stainless steel clevis style hangers with PVC coating to reduce abrasion and prevent electrolysis between hanger and dissimilar metallic pipe material.
2. Beam attachment lugs or brackets and hanger rods shall meet schedule and fastener grade in accordance with National Fire Protection Association 13 (NFPA 13).

E. Valves and Fittings

1. General:
 - a) Furnish all valves as shown on drawings or wherever required for proper control and servicing of piping systems and equipment.
 - b) All mains, branch mains and sub-branch mains, which supply two or more fixtures and all plumbing, risers and mains, shall be valved in such a manner that it will permit their isolation from the system of piping of which they are a part.
 - c) Each item of equipment including automatic control valves shall be individually valved so that it can be completely isolated.
 - d) Provide a minimum of one union at every valve, strainer or item of equipment.
 - e) Working Pressure: The working pressure of valves shall not be less than the maximum working pressure of the system in which they are installed.
 - f) One standard 3/4" hose bib shall be provided by each berth. Branches to each hose bib shall be 1/2" nominal pipe and shall be provided with a backflow preventer.
 - g) Faucets shall be made of solid brass with 1/2" male inlet threads, hexagon shoulder, and minimum 1/2" hose connection.

2. Valve Types

a) General:

- I) Service valves suitable for operation up to 120 psi working pressure for water shall be in accordance with the following Paragraphs:
- II) All valves of a specific size and type shall be supplied from a single manufacturer, selected from those indicated within this specification.

b) Gate Valves 125 pound class in sizes up to and including 2-inch shall be all bronze, screwed bonnet, non-rising stem, solid wedge disc type and threaded pipe connections. Valve construction shall allow repacking under pressure when wide open. Valves shall be one of the following:

- I) Crane 1700
- II) Milwaukee 148
- III) Stockham B-100
- IV) Walworth 55

c) Gate Valves 125 pound class, in size 2-1/2 inch and over shall be iron body, bronze mountings (IBBM), bolted bonnet, rising stem outside screw and yoke (OS & Y), solid wedge disc type and flanged pipe connections. Valves shall be one of the following:

- I) Crane 465 ½
- II) Milwaukee F2885
- III) Jenkins 651c
- IV) Stockham G-623

d) Swing Check Valves 125 pound class, in sizes up to and including 2-inch, shall be all bronze, square head screw cap, with renewable seat and renewable disc able to be reground. Units shall have side plugs for a disc carrier pin-bearing. Valve shall have screwed pipe connections. Valves shall be one of the following:

- I) Crane 1707
- II) Stockham B319
- III) Jenkins 996

e) Ball Valves 600 pound class, in sizes up to and including 2-inch, shall be brass or bronze construction with two-piece body construction, stainless steel balls, and threaded pipe connections. Base to be free footing dual seat sealed. Valve shall include removable handle and one-fourth turn from full open to full close. Valves shall be one of the following:

- I) Worcester 4211R
- II) Powell 4210-T
- III) Crane 9302
- IV) Apollo 70-100
- V) Milwaukee BA-100

VI) Stockham S-126-BR-RT

- f) Backflow Preventers 175 pound class in sizes ½” to 3” shall be double check valve assemblies. Bodies shall be bronze (1/2” to 2”) or fused epoxy coated cast iron. Valves shall be Model 007 manufactured by Watts, and shall be provided to each hosebib.

3. Quick Disconnect Couplings:

- a) Quick Disconnect couplings shall be an automatic or positive-locking cam and groove type couplings designed to operate under low pressure and vacuum applications. Dust Caps shall be provided for all fittings to be installed following winterization of the system.
- b) Quick disconnects shall utilize threaded end fittings to adapted to copper tubing/ductile iron as appropriate. Transition from the flexible hose to the coupling shall be made by a hose shank adapter fitting held by a notched/swaged ferrule. Hose shank fittings which require hose clamps shall not be accepted.
- c) Fittings shall be full bore with no restriction of inside pipe diameter. Fittings which restrict the inside pipe diameter or rely on poppet-type mechanisms shall not be accepted due to head loss and the potential for fouling.
- d) Fitting shall be rated for a minimum of 150 psi positive pressure and 50 psi vacuum.
- e) Fitting Orientation: To prevent interchanging with the sanitary sewer system, female fittings shall be mounted to the flexible hose with male fittings mounted to the fixed pipes on the dock, gangway, and land.
- f) Products: Fittings shall be one of the following
 - I) APG Ever-Tite 340CLHSS102 Fitting, and 340FRLASS Ferrule
 - II) Dixon EZ Boss-Lock Stainless Steel 400 Series with Interlocking Ferrule.
 - III) OPW AutoLok 733CL-SS40 Series with Notched Ferrule

4. Fittings:

- a) All fitting in copper tubing 3 inches and larger shall be cast red bronze solder type fittings, meetings the standards of ANSI B 16.18 and ASTM B62. Fittings of either type shall have tubing stops.
- b) In all cases where copper pipe connections are made to piping or an item of equipment of a dissimilar metal, provide dielectric fittings pipe and fittings with water works brass valves and hose bib connections.

F. Winterizing System: The potable water system should be equipped with drains at the end of each pier and locations near the landside gangway connection for the connection of compressed air to purge lines prior to winter freeze up.

2.14 FIRE SUPPRESSION

A. Fire Centers

- 1. General: Fire centers shall be located per NFPA 303 and as shown on the plans to provide no more than 75’ spacing between fire centers.

2. Construction

- a) Housing: Fire centers shall be constructed of aluminum housing with oven-baked enamel finish with polycarbonate base and top. The finish shall be white in color.
 - b) Lighting and Siren: Fire centers shall be equipped with a 13-watt photocell controlled florescent night light. Lighting shall be tied in to the utility pedestal photocell control for uniform control over all dock lighting. Alarm strobe light and siren shall be automatically activated when door is open.
 - c) Fire Suppression Equipment: A 10 lb. standard ABC type fire extinguisher shall be located in each fire center. Easy access to fire extinguishers shall be provided through a hinged clear polycarbonate door.
 - d) Rescue Equipment: A 24" standard life ring shall be provided with each fire center.
 - e) Signage: Fire Centers shall be equipped with DiBond aluminum per the signage portion of this specification. The signage shall be red lettering on white substrate. This signage shall indicate the direction and distance, in feet, to the nearest connection point to land.
3. Products: The fire centers shall be "Firehouse" type, as manufactured by Eaton Marina Power and Lighting, Inc., 1-800-723-8009 (p), (757) 258-8805 (f).

2.15 SANITARY PUMP-OUT

A. General

1. In-slip pumpout service shall be provided to all slips 50 feet and larger and broadside mooring locations as shown on the plans.
2. The work includes installation of four (4) complete pump-out systems on land and over water, three of these to service a single main pier (Pier G-I) and a single pump servicing Piers J/K/L.
3. The Fuel Dock shall be serviced by two (2) Point-of-Use pumpouts both discharging to a common force main on dime pier.
4. Pumpout systems shall include High Density Polyethylene (HPDE) Suction Lines and flexible pipe connections for the gangway and between dock units, portable hose reel, sewage pump, below-deck sewage hydrants, above-deck service stanchions, valves, and appurtenances, as shown on the drawings and as specified herein.

B. Pipe Materials and Appurtenances

1. Sewer Force Mains: All force mains shall meet the requirements of Section 02635 Sanitary Sewer Force Mains and Appurtenances.
2. Sewer Suction Lines: All suction lines shall be high density polyethylene (HDPE) pipes with joints meeting requirement of 150 PSI working pressure and 200 PSI hydrostatic pressure.
3. Piping exposed to weather shall have expansion joints. The maximum spacing for expansion joints shall be 100 ft.

4. All suction line or force main pipe mounted to floating docks shall be provided with flexible Victaulic-type couplings or hose type joints at each dock unit and access pier connection point to accommodate deflections due to impacts, wind loading, and wave action.
- C. Flexible Hose:
1. General: Flexible hose shall be food-grade corrugated nitrile designed for pressure or suction applications. The hose shall be sized per the plans.
 2. Product: Flexible hose shall be Saniflex SW432 Food Grade Flexible Nitrile Hose by Titan Industries, 11121 Garfield Avenue, South Gate, CA, 90280, Phone 1-800-862-1922.
- D. Pipe Hangers:
1. All pipe hangers shall be UL listed stainless steel clevis style hangers with PVD coating to reduce abrasion and prevent electrolysis between hanger and dissimilar metallic pipe material.
 2. Beam attachment lugs or brackets and hanger rods shall meet schedule and fastener grade in accordance with National Fire Protection Association 13(NFPA 13).
 3. Hardware: Hardware, including bolts, nuts, screws and washers shall be manufactured using Type 316L stainless steel for superior corrosion resistance in the marine environment. All nuts shall be non-galling brass nuts with nylon locking insert.
- E. Valves:
1. Check Valves shall be full opening swing-type check valves as recommended by the pumpout system manufacturer.
 2. Ball Valves: Ball Valves shall be 3 inch, full-bore, 600 pound class (min.), shall be all-stainless steel with two-piece body construction, stainless steel balls, and threaded pipe connections. Base to be free footing dual seat sealed. Valve shall include removable handle and one-fourth turn from full open to full close. Valves shall be one of the following:
 - a) Crane 9431S
 - b) Milwaukee BA-260
 - c) Watts 3 S FBV 1
 3. Quick Disconnect Couplings:
 - a) Quick Disconnect couplings shall be an automatic or positive-locking cam and groove type couplings designed to operate under low pressure and vacuum applications. Dust Caps shall be provided for all fittings to be installed following winterization of the system.
 - b) Quick disconnects shall be utilize e threaded end fittings mated to HDPE butt fused transition fittings. Transition from the flexible hose to the coupling shall be made by

a hose shank adapter fitting held by a notched/swaged ferrule. Hose shank fittings which require hose clamps shall not be accepted.

- c) Fittings shall be full bore with no restriction of inside pipe diameter. Fittings which restrict the inside pipe diameter or rely on poppet-type mechanisms shall not be accepted due to head loss and the potential for fouling.
- d) Fitting shall be rated for a minimum of 150 psi positive pressure and 50 psi vacuum.
- e) Fitting Orientation: To prevent interchanging with the potable water system, male fittings shall be mounted to the flexible hose with female fittings mounted to the fixed pipes on the dock, gangway, and land.
- f) Products: Fittings shall be one of the following
 - I) APG Ever-Tite 330CLHSS102 Fitting, and 340FRLASS Ferrule
 - II) Dixon EZ Boss-Lock Stainless Steel 300 Series with Interlocking Ferrule.
- g) OPW AutoLok 733CL-SS30 Series with Notched Ferrule

F. Sewage Pump:

1. General - Sewage pump shall be EMP Industries peristaltic type pumps and shall be housed in a weathertight and resistant enclosure, provided and installed by CONTRACTOR per manufacturer's instructions. The pump will produce the suction and discharge pressures required to collect and transfer sewage from vessels located in their respective slips to a landside sewage manhole as shown on the plans. Pump, motor and control panel will be housed under a removable white fiberglass enclosure.
2. Pump Models
 - a) Central Suction Pumps: EMP Industries Model CV-5400 peristaltic type pumps. Pumps shall be complete with 5 HP TEFC electric motor and other necessary electrical and mechanical components to provide a complete functional pump assembly. The pump shall be completely self-contained with no exterior electrical components. Pump shall have a capacity of at least 60 GPM when operating at a suction lift of at least 15 feet vertical and a discharge head of at least 50 feet vertical.
 - b) Point of Use Pumps: EMP Industries Model M-300 peristaltic type pumps. Pumps shall be complete with 3 HP TEFC electric motor and other necessary electrical and mechanical components to provide a complete functional pump assembly. The pump shall be completely self-contained with no exterior electrical components. Pump shall have a capacity of at least 25 GPM when operating at a suction lift of at least 15 feet vertical and a discharge head of at least 67 feet vertical.
3. Controls
 - a) Pump Activation will be NEMA 4X Color Coded Push Buttons (Green Push to START and Red Push to STOP). A built in timer will be located at the pump control panel that will automatically shut off the pump if left running for more than 20 minutes. Push button assembly (start/stop) shall be located on the above-deck hydrant stanchions located at the dock ends. Each remote control will be wired back to the pump using low voltage wiring.
 - b) An adjustable non-mechanical electric timer enclosed in a weatherproof housing shall control the pump motor. Timer shall be field adjustable, solid state and operate at the

specified control voltage of 24VAC. Timer shall turn off the pump-out unit after the set operating period and housed in a NEMA 4X weatherproof electrical enclosure.

- c) Pump housing shall be equipped with a mechanical float switch to detect internal peristaltic hose failure and disable pump upon detection of fluid. Pump housing shall contain sewage in the event of an internal hose failure.

4. Portable Hose and Hose Reel: A portable hose reel will function as hose storage and will connect the suction hose to the dock-mounted hydrant. Hose reel shall be capable of holding 60' of suction hose and should be stored in a centralized location allowing access to the suction hose reel. Simple transportation of the suction hose and pumpout deck fittings shall be allowed to the hydrants located on the docks. Hose reels shall be equipped with wireless on/off switch as described under Controls. Fittings shall consist of male camlock adapter, full opening plastic threaded ball valve and quick connect neoprene adapter for marine sanitation connection. Hose clamps shall be stainless steel and be covered by heat shrink.
5. Installation - Installation shall be as shown and in accordance with manufacturer's written recommendations.

- G. Warranty: The system shall be warranted by the manufacturer against defective materials and workmanship for a period of three (3) years.

2.16 SLIP SIGNAGE

A. General

1. Pier Identification and slip address signage shall be provided to aide way-finding by both boaters and pedestrians. Signage shall be provided at all slips, tee piers, and broadside mooring locations provided with utility pedestals. Addresses shall be assigned by the marina operator.
2. Signage shall be clear and legible with contrasting legend on uniform background. Slip addresses mounted to utility pedestals shall bear the appropriate identification legend in the sizes indicated below.
3. All signs shall be pre-drilled and countersunk to prevent marring of the surface during installation and flush fastener installation.

B. Material

1. Sign Substrate: All signs shall be constructed of Dibond aluminum composite material. The nominal thickness of the sign shall be 3 millimeters comprised of 0.12" painted aluminum sheets mounted to a solid polyethylene core. Signs shall be router-cut to the size and shape shown on the plan.
2. Legend and Symbols: All legends shall be high-intensity die-cut vinyl tape material designed for exterior use with a 10-year life expectancy.

C. Slip Identification

1. Pedestrian Slip Identification:

- a) Signage shall be White legend on Ultra Marine Blue background.
- b) Pedestrian Slip Identification signage: 3”W x 4”H signs with 1” legend shall be installed in a conspicuous and uniform location on all Utility Pedestals. Installation shall be horizontally centered and plumb legibility and appearance.
 - D) Slip addresses mounted to dock boxes shall bear the pier name and slip number legend in the sizes indicated below.
 - a. Legend: Pier Name and Slip Number: 1.0 inches
 - b. Font: Arial
- c) Fastening: Signage shall be fastened to the utility pedestal with two tamper-resistant TORX® head bolts with flat washers. Nuts shall be free-cutting brass in accordance with IS 319 (i) or BS 249 (i). Nuts shall be supplied with nylon locking inserts.
- d) Sealing: An exterior-grade, primerless, clear silicone adhesive sealant shall be applied to the reverse of the sign to prevent moisture from entering the receptacle cover. Sealant shall be formulated for instant adhesion and approved for gasket/assembly applications with electrical equipment. Suitable manufacturers are Dow Corning, General Electric, and DAP.

2. Boater Signage:

- a) General: Signage shall be White legend on Ultra Marine Blue background. Signage shall be adequately sized to be legible for passing boaters.
- a) Pier Identification: 8”W x 8”H sign with 6” legend shall be installed, two per main pier, centered on the ends of the finger piers closest the main fairway. Signage shall be affixed to the skirting by means of stainless steel hardware. Signage shall be adequately sized to be legible for passing boaters. Pier Identification shall bear the name of the pier only.
 - a. Legend: Pier Name: 6.0 inches
 - b. Font: Arial
- b) Slip Identification: 8”W x 8”H sign with 4” legend shall be located on the end of each finger pier, installed 4 inches from the side of the corresponding slip. Signage shall be affixed to the skirting by means of stainless steel hardware. Signage shall be adequately sized to be legible for passing boaters. Slip Identification shall bear the appropriate pier name and slip number only.
 - c. Legend: Pier Name and Slip Number: 4.0 inches w/ 0.8 width factor
 - d. Font: Arial
- c) Fasteners: Signage shall be affixed to the skirting by means of stainless steel wood screws. Screw heads shall be tamper resistant TORX® heads, installed flush with the sign face to prevent property damage or injury.

2.17 GANGWAY CONNECTION

- A. Gangways shall be marine grade aluminum per Section 02005 Floating Dock Access Gangways.
- B. All landside connection assemblies shall be fully articulated 5th wheel type connections. The gangway shall bear on a single point to allow freedom of movement in the horizontal as well as vertical plane.
- C. Bearing Plates
 - 1. Wheels/rollers shall bear and run on two Teflon coated or UHMW plastic plates mounted to the deck surface. The width of the bearing plates shall be closely coordinated with the rollers provided on the gangway and the length shall be sufficient to prevent loss of contact with the bearing plate throughout the entire range of motion for the specified water elevations.
- D. Decking
 - 1. Decking surface shall match the decking material of adjoining docks, and shall be grooved to provide a non-slip walking surface.
- E. Transition plate shall be rust resistant aluminum or stainless steel with “diamond plate” non-skid finish.

2.18 SAFETY LADDERS

- A. General
 - 1. Ladders shall be constructed of Marine Grade Aluminum, galvanized steel, or galvanized steel, in accordance with accepted Engineering practice. Clear spacing between rails shall be 16” to 24”, with the center spacing of the rungs between 10” and 12”. The bottom of the ladders shall be 36” below the still water level for floating docks.
 - 2. Ladders shall be installed as shown on the plans.
 - 3. The ladders shall be of lift ladder seven (7) step regular type. The ladders shall be liftable such that they rise up out of the water when not in use to avoid ice damage during winter month.
- B. Products: Floating Dock Lift Ladders shall be as follows:
 - 1. Floating Dock Lift Ladder: Manufactured by International Dock Products, Inc., 3101 S.W. 25th Street, Bay 106 Pembroke Park, Florida 33009, Phone: (954) 964-5315,, Fax: (954) 964-2715, Toll Free: (800) 909-DOCK (3625)
 - 2. Superior Marine Ladders - Floating Dock Lift Ladder: A1A Dock Products, Inc., 5745 Plunkett Street, Hollywood, Florida, 33023, Phone (954) 986-2366, Fax (954) 986-1357, Toll Free (866) 986-2366

3. Floating Dock Lift Ladder: Manufactured by Universal Marine Lift, Inc., 6160 N Bluffs Ct, Charles City, VA 23030, Phone (804) 337-6642, Fax (866) 475-1774.

2.19 FISHING PIERS

- A. General: Fishing piers shall be constructed in accordance with the same material specifications as typical floating docks and shall incorporate the following additional features to ensure compliance with all federal and local ADA barrier-free codes as well as United States Access Board guidelines for Accessible Fishing Piers & Platforms (June 2003).
- B. Safety Related Equipment:
 1. Rub Rail:
 - a) Lumber:
 - I) Treated Lumber: Lumber for Rub Rail and standoff blocks shall be 4"x 4" No. 1 Southern Yellow Pine. The lumber shall conform to the rules of the Southern Pine Inspection Bureau. Lumber shall be dried to the moisture content as per association rules.
 - II) Lumber shall be subjected to certificate inspection conducted to regrade the material after treatment. This shall include inspection for those defects subject to developing during the treatment process, such as warping or splitting.
 - b) Treatment: Treatment shall be
 - I) Timber and lumber shall be pressure treated in accordance with American Wood Protection Association (AWPA) Use Category UC4C as is appropriate for Northern Freshwater Marine Environments. Lumber cut or drilled after treatment shall receive two heavy coats of the preservative on exposed surfaces in conformance with American Wood Preserves Association (AWPA) UC4C, C18.
 - II) Preservative (MCA/MCQ Micro Pro) shall have a retention by assay of treated wood of 0.24 pounds per cubic foot for MCA and 0.6 pounds per cubic foot for MCQ.
 - III) A paraffin based water repellent shall be included with the treatment phase to increase the water repellency and dimensional of the material.
 - c) Moisture Content: Lumber shall be kiln-dried after the treatment phase (KDAT) to achieve proper moisture content, 19% maximum.
 - d) Material Storage and Handling:
 - I) Lumber shall be stored in a covered outdoor location, elevated off the ground and stacked to allow adequate air circulation.
 - II) Lumber shall be delivered to the dock assembly site and allowed to acclimate for a minimum of 14 days prior to installation on the dock. During this time, the wood shall be handled and stored in accordance with AWPA recommendations to allow thorough acclimation of the decking material to the temperature and relative humidity.

- e) Fastening: Rub Rails shall be through- bolted to the dock structure with two carriage bolts per standoff block. Bolts and related hardware shall be in accordance with the material requirements of Paragraph 2.04 of this specification.
2. ADA Fishing Pier Railing:
- a) Material:
 - I) Steel Tubing: Schedule 40 steel tubing shall be hot dip galvanized in accordance with ASTM A123 and manufactured expressly for this application.
 - II) Mounting Flange: Grade A36 plate steel, sized per the plans.
 - b) Corrosion Protection:
 - I) All steel members shall be galvanized in accordance with ASTM A123. The minimum zinc coating thickness shall be 2.0 oz per square foot.
 - II) All members shall be hot-dip galvanized after drilling, welding, and fabrication operations have been completed.
 - III) All holes for the attachment of cleats, pile guides, Utility Pedestals, etc shall be installed prior to the galvanizing process. Any holes, cuts, or perforations occurring after galvanizing shall be repaired with high zinc content paint or a cold galvanizing process.
 - c) Fasteners: Steel: Mounting flanges shall be through-bolted to the dock structure with 4 bolts per flange. Where necessary to maintain adequate decking thickness over the mounting flange, low profile bolt heads may be used. Bolts and related hardware shall be in accordance with the material requirements of Paragraph 2.04 of this specification.
 - d) Paint:
 - I) Base: Low Sheen universal acrylic primer
 - a. Apply one coat at 2.0 to 4.0 mils thickness
 - II) Finish Coats: High-Gloss Silicon Alkyd for use on exterior steel applications and rated for severe service.
 - a. Apply in accordance with manufacturer's recommendations for severe service.
 - III) Color: White
3. Signage:
- a) General:
 - I) ADA signage shall be provided and installed on the ADA Fishing Pier Railing to designate ADA Fishing locations.
 - a. A single sign shall be provided at single fishing access points. The sign shall be installed at the top of the vertical pickets and horizontally centered on the lower railing section.
 - b. Two signs shall be provided at tandem access points. The signs shall be installed at the top of the vertical pickets and spaced 15 inches left and right of center on the lower railing section.

- II) The sign shall display a white legend on an Ultra Marina Blue background depicting a handicapped symbol with a uniform 0.5 inch border
- b) Materials:
 - I) All Signage shall be DiBond aluminum composite in accordance with Paragraph 2.16.A & B of this specification.
 - II) Fishing Pier Signage shall be 30"x12" with legend as follows:
 - a. Line 1: FISHING PIER 3 inches
 - b. Line 2: NO MOORING 3 inches
 - c. Font: Arial
 - III) ADA signage shall be 8"x8" with ADA Symbolic Legend
- c) Fastening:
 - I) Fishing Pier Signage: Shall be placed two (2) per fishing pier, centered vertically on the skirting facing the marina. Placement shall be 50' from each end.
 - II) ADA Signage shall be fastened at all corners to the ADA Fishing Pier Railing by means of stainless steel brackets and with two tamper-resistant TORX® head bolts with flat washers. Nuts shall be free-cutting brass in accordance with IS 319 (i) or BS 249 (i). Nuts shall be supplied with nylon locking inserts.

PART 3 - EXECUTION

3.01 SYSTEM DESIGN

- A. The design shall be executed and certified by persons with established ability in structural design and analysis of marine structures and operations. This person shall be a registered professional engineer, licensed in the State of Illinois and meeting experience requirements set forth in Paragraph 1.04.A and 1.06.C.1.c of this specification.
- B. Design drawings shall be approved prior to the start of fabrication.
- C. The design loads given shall be considered as the minimum loads to which the structure will be submitted.
- D. The design shall establish the ability of the structure to withstand these loads, in combination as given without damage to the structure throughout the minimum design life of the system, which is 25 years under the design conditions and maintenance.

3.02 DESIGN LOADINGS

- A. General: Unless specifically required below, all design loads shall be in accordance with ASCE Manuals and Reports on Engineering Practice No. 50, Planning and Design Guidelines for Small Craft Harbors (1994).
- B. Vertical Loads

1. Dead Load: Actual weight of all permanent components of the structure, including parts to be placed and/or attached to the structure. This will include cleats, bumpers, dock boxes, dock utilities, lights, decking, and all other appurtenances.
2. Live Load
 - a) Loads resulting from people, ice and snow, and supplies stored on the piers or walkways, or inside buildings on the piers.
 - b) The deck structure shall be designed to support a minimum uniformly distributed live load of 100 psf and a 400 pound concentrated live load on any 1 square foot of deck surface.
 - c) The support structure and flotation shall be designed to support a minimum uniformly distributed live load of 30 psf.

C. Horizontal Loads

1. Wind Loads
 - a) Walkways and piers shall be designed to withstand a lateral load of 15 pounds per square foot on all projected surfaces, assuming 100% occupancy, due to a wind from any direction. Wind load on hidden rows of boats shall be calculated using a shielding factor, S.
 - I) For boats in the first hidden row, the lateral loading shall be based on a shielding factor, S= 0.50.
 - II) For boats in the second and all subsequent hidden rows, the lateral loading shall be based on a shielding factor, S= 0.30.
 - b) Profile heights shall be as follows:

SLIP LENGTH (FEET)	PROFILE HEIGHT (FEET)
0 – 30'	7.0'
35'	8.5
40'	9.5'
50'	12.0'
60'	14.0'
70'	16.0'
80	18.0'
100'+	22.0'

D. Impact Load

1. The dockage system shall be designed to withstand a lateral impact load, which may occur on any portion of the system, of a vessel with a velocity component normal to the dock of 3.0 fps. This corresponds to a velocity of approach of 3.4 knots at an angle of 10 degrees to the face of the dock. The minimum weight of the boat being determined by $Weight = 12 \times L^2$ (L = length of largest boat to be berthed in the area of design).

2. For purposes of design and structural calculation, the weight of the largest boats shall be as follows:

SLIP LENGTH (FEET)	BOAT WEIGHT (LBS)
0 – 30'	22,000
31'-35'	31,000
36' - 45'	45,000
46' – 60'	80,000
61' - 80'	130,000
81' – 90'	170,000
91' – 100'	210,000
100'+	250,000

3.03 DESIGN LOADING PERFORMANCE

A. Dead Loads

1. Dock manufacturer shall provide the dead load design freeboard on the dockage system submittal drawings. The freeboard for the dead load shall be between 20 and 24 inches.
2. At the time of acceptance, the actual freeboards shall be within 1 inch (2.5 cm) + of the dimension delineated on the submittal drawings.
3. Dockage system shall lose no more than 1 inch (2.5 cm) of freeboard at the end of 1 year of service, and no more than 2.0 inches (5.0 cm) at the end of 5 years, as measured from the freeboard at the time of acceptance.
4. Marginal and main walkways shall not slope more than 1/2 inch in 6 feet (1.2 cm in 1.8 meter) of length or width at the time of acceptance, nor more than 3/4 inch in 6 feet (1.9 cm in 1.8 meter) at the end of 5 years.
5. Finger piers shall have the outer end level with, or be no more than 2 inches (5.0 cm) higher than the elevation of the header walkway to which it attaches.
6. Deck surfaces of adjacent finger piers shall not contain a grade differential of more than 1/8 inch (0.3 cm).
7. Outer corners of the finger piers shall not contain a grade differential of more than 1/2 inch (1.2 cm) for each 2.5 feet (75 cm) of width, at the time of acceptance, nor more than 3/4 inch (1.9 cm) at the end of 5 years.
8. Main or Header walkways under gangways shall be level with, or be no more than 2 inches (5.0 cm) higher than the freeboard on the rest of the walkway. Additional flotation shall be provided beneath permanent equipment and gangway bearing locations to ensure consistent freeboard and level surface. All floating main or header piers shall comply with ADA slope requirements regardless of gangway length.

B. Live Loads - Vertical

1. The floating dockage system, under full live load, shall have a minimum free board of 18 inches.
2. The outer end of the finger piers shall not lose more than 4 inches (10 cm) of freeboard, at the time of acceptance, under a 400 pound concentrated live load at 12 inches (30 cm) from the outer end of the pier. At the end of 5 years, the loss of freeboard shall not exceed 6 inches (15 cm).
3. Under a concentrated live load of 200 pounds (91 kg) applied on one outer corner of the finger pier, there shall be no more than 1.5 inches (5 cm) in freeboard differential per 2.5 feet (75 cm) of width, between the outer corners of the finger piers, at the time of acceptance. At the end of 5 years, the freeboard differential shall not exceed 3 inches (15 cm).
4. Main or Header walkways under gangways shall be level with, or no more than 2 inches (5.0 cm) lower than the rest of the walkway under a fully loaded gangway condition. Additional flotation shall be provided to ensure proper elevation and compliance with all applicable ADA slope requirements.

C. Live Loads - Horizontal

1. The floating dockage system (piers, flotation and anchorage system) shall withstand the forces of non-moving ice without damage, fracture, or puncture. The pier system including bridges and anchorages shall be capable of withstanding wave agitation as described in paragraph 3.04.

D. Torsion

1. Positively prevent torsion, racking and twisting by providing sufficient built-in torsional resistance to prevent no more than 3" variation from normal dead load freeboard at the free end of all dock units of whatever length (30' or longer) due to impact design loadings transferred through the fender system.

3.04 WAVE AGITATION:

- A. General: The floating dockage systems shall be designed to withstand the following anticipated wave conditions. This wave forecast has been based on computer and physical modeling study performed on the proposed breakwater for specific design storm events ranging from yearly waves to 100-year return events. Results are presented below and are based on a ratio of $H_s/H_{m0} = 0.80$. Where H_{m0} represents the characteristic wave height and H_s represents significant wave height.

1. Wave Period:
 - a) East Wave: 9.5 seconds
 - b) South Wave: 8.5 seconds

2. Typical Wave Conditions: Significant wave heights (H_s) ranging from 0.7 to 1.1 feet. This condition may exist within the harbor several times in a given year. The system shall be designed to withstand this event without damage and shall not require special preparation or maintenance provisions to be undertaken before or after such an event.
 3. 20-Year Wave Event: Significant wave heights (H_s) ranging from 1.2 to 1.7 feet. This condition may exist within the harbor once every ten to fifteen years. The system shall be designed to withstand this event without damage and shall not require special preparation or maintenance provisions to be undertaken before or after such an event.
 4. 100-Year Wave Event: Significant wave heights (H_s) ranging from 1.6 to 2.3 feet within the harbor. This condition will be infrequent, with only a 1% chance of occurrence within any year and a 40% chance of occurrence within 50 years. The system shall withstand this design storm without incurring significant or widespread (involving 25% or more of the dock surface per pier) structural damage to the anchorage (piles, chains or guides), dock frame, or flotation.
- B. Storm Preparation Plan: During a 100-year event, it is recognized that moored vessels and other dynamic/impact mechanisms pose a significant risk of damage to the dock structures. The manufacturer shall submit a procedure for storm preparation of the dockage system and moored vessel. This procedure shall be documented in the Operations & Maintenance Manuals submitted upon project completion.
1. This procedure shall be limited to tasks as can be performed rapidly by operations staff with the docks and vessels in place and without the need for special tools or equipment.
 2. Large-scale efforts, such as rafting of pier sections or relocation of vessels may not be practical and shall not be permitted as part of the Storm Preparation Plan.

3.05 DOCK UTILITIES

A. Water Distribution:

1. Pressure Testing
 - a) General: Before making tests, the Contractor shall make sure that all turns, intersections, ends and reductions have been restrained by proper thrust blocking. All new pipes, including hydrants and water service piping to the curb stop, shall be tested. All air shall be expelled from the mains and they shall be filled with water.
 - b) The hydrostatic testing of the completed water main shall conform to the conditions and requirements of Section 13 of AWWA Standard C600. The Contractor shall backfill the trench before commencing the test. The test pressure of the water main shall be 150 psi for a test period of two (2) hours. The maximum allowable length of water main to be tested at one time shall be 1,000 feet or the minimum distance between valves. The Contractor shall not be allowed to raise the pressure in the water main above 160 psi at any time during the testing procedure. The allowable leakage shall not exceed that amount determined by the formula:
 - I) Where:
D = nominal pipe diameter in inches;
L = allowable leakage in gallons per hour;

P = average test pressure (psi); and
 S = length of pipe to be tested.

- c) The cost of the testing of the pipe lines shall be borne by the Contractor who must furnish all necessary equipment for the tests. The Contractor may, upon special request, test pipe segments longer than 1,000 feet, but the allowable leakage shall be calculated as indicated in Paragraph #2.
- d) Contractor shall insure hydrostatic testing which shall meet the local utility requirements.

2. Flushing and Disinfection

- a) All new water systems or extensions to existing systems shall be thoroughly flushed and disinfected before being placed into service. Water from all new mains must successfully pass two (2) safe, consecutive bacteriological tests 24-hours apart in accordance with the requirements of the local water department and all applicable state and federal requirements before the main is placed in service.
- b) Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, then a tap should be provided large enough to develop a velocity of at least two and five-tenths feet per second (2.5 fps) in the main. One two and one-half inch (2-1/2") hydrant opening will, under normal pressures, provide this velocity in pipe sizes up to and including twelve inches (12").
- c) Chlorination of the pipeline may be with liquid chlorine, calcium hypochlorite granules and tablets or with sodium hypochlorite solution. Chlorination should be accomplished only by workmen who have had experience with chlorine. A chlorine concentration of at least 50 mg/l of available chlorine shall be maintained in the pipeline for at least 24 hours.
- d) The Tablet Method is generally used for short extensions up to 2,500 feet of twelve inch (12") and smaller diameter mains. The required number of tablets are placed on the top of each joint and held in place by an approved mastic. The main is then filled with water at a velocity of less than 1 fps and the water is left in the main for at least 24 hours before flushing. The table below indicates the number of tablets required for each size of pipe up to 12 inches (12") in diameter.

NUMBER OF HYPOCHLORITE TABLETS OF 5-G

NUMBER OF HYPOCHLORITE TABLETS OF 5-G REQUIRED FOR DOSE OF 50 mg/l *						
Length of Section (Ft.)	Diameter of Pipe (In.)					
	2	4	6	8	10	12
13 or less	1	1	2	2	3	5
18	1	1	2	3	5	6
20	1	1	2	3	4	7
30	1	2	3	5	7	10
40	1	2	4	6	9	14

* Based on 3-3/4 g available chlorine per tablet.

- e) The Slug Method of chlorination is used for large diameter water mains and long lengths of new water mains. The preferred point of application of the chlorinating agent is at the beginning of the pipeline extension or any valved section of it, and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipeline extension. Alternate points of application may be used when approved or directed by the CR. A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device, or the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas, or the gas itself, must provide means for preventing the backflow of water into the chlorine. Water from the existing distribution system, or other source of supply as approved by the CR, shall be controlled to flow very slowly into the newly laid pipeline during application of the chlorine. The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the newly laid pipe that the dosage applied to the water will be at least fifty (50) parts per million unless otherwise directed by the CR.
- f) The chlorine residual, as free C1-2, shall not be less than ten (10) PPM as determined at the end of the line after twenty-four (24) hours. Upon approval of the CR, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its length shows, upon test, the absence of chlorine. In the event chlorine is normally used in the source of supply, then the test shall show a residual not in excess of that carried in the system.
- g) It will be the Contractor's responsibility to properly sample water from the newly flushed locations throughout the system in an approximate number equal to one for every 1,000 feet of new pipe. Samples found to be unsafe will require resampling of that section of the main. The CR may require reflushing and/or rechlorination to obtain a "safe" sample. Retesting will be done at the Contractor's expense until safe samples are obtained. Delays in disinfection shall in no way create liability on the part of the Owner.

3.06 MAINTENANCE AND WINTERIZING

- A. For Winterization, all lines to be pressurized and drained shall be run at a minimum slope to accomplish draining. Minimum drop shall be 1 vertical inch in 100 horizontal feet.

3.07 SEWER SUCTION LINES

A. Installation

- 1. HDPE Pipe: CONTRACTOR shall install HDPE pipe in accordance with Chapter 8 of the Handbook of PE (Polyethylene) Pipe, "Aboveground Applications for PE Pipe. HDPE Pipe and fittings shall be fastened to the dock abutment, platform, gangway and ramp as shown on the drawings and as specified herein. Axial movement in straight sections of piping shall be permitted by not fastening pipe hangers too tightly around the pipe. All 90 and 45 degree fittings shall be fastened securely to prevent movement. Flexible hoses shall be used at each end of pipe attached to gangway and at all other locations where rotational movement is possible.

2. Valves shall be installed where shown or in accordance with manufacturer's instructions.

B. Pressure Testing

1. Pipeline leakage testing shall be accomplished using the water ex-filtration method in accordance with section 306-1.4, "Testing pipelines," SSPWC, and the line shall be repaired if necessary. Leakage test shall be done before the sewage pumps are connected to the piping system (hydrostatic testing of sewage pumps will cause extensive damage to the pump).
2. Pipeline vacuum testing shall be accomplished using equipment designed specifically for this type of testing and in accordance to the following method. With the pipeline openings sealed and braced, a negative pressure shall be introduced into the pipeline until a gauge pressure of 25.0 inches of Hg has been reached at which time the vacuum shall be reduced and maintained to between 23.0 and 25.0 inches of Hg gauge pressure for at least 2 minutes. The negative pressure shall be maintained for 20 minutes which at no time shall the pressure be less than 23.0 inches of Hg. Vacuum test shall be done before the sewage pump is connected to the piping system.

C. Start-Up Test

1. At the completion of the work, conduct operational tests for the entire new sewage pumpout system for a period of 1 hour. This test shall be completed using lake water as the testing medium. In addition to this one hour running test, the system shall be tested for the following:
2. Operate the system dry. Sewage pump shall be evaluated for excessive vibration by operating the system dry. Conduct this test for a period of 15 minutes and the satisfaction of the CR. This test shall be performed prior the beginning of the 1-hour test period.
3. Operate the system recording the elapsed time required to empty a five-gallon container of water at the suction hose. The time required to empty the five-gallon container shall not exceed 15 seconds. This test shall be performed prior to and after the one-hour test period.

3.08 PLACING PILING

A. Splicing and Handling of Piles

1. Splicing, handling, transporting, and driving of piles shall be carried out in such a manner as to ensure that the piles are not damaged in any way. Any injury to the pile which causes an indentation of 1/2 the wall thickness or greater, or creates a hole, tear or separation of a seam shall be considered to be significant damage and the pile will be rejected. Any minor damage to the pile or pile coating shall be repaired and approved by the CR prior to installation.
2. Full-length piles shall be used where practical. Piles shall be spliced, if required, before being placed in the leads. The lengths of pipe to be spliced shall be secured in proper alignment such that there is no eccentricity between the spliced sections after the splice has been completed. Not more than one splice per pile will be permitted unless otherwise approved by the CR. Steel pile sections shall be spliced using a continuous butt joint

with a 45-degree bevel or tee. The weld must provide a complete penetration arc weld around the entire circumference and should produce a ductile watertight joint providing 100 percent of the pile strength.

B. Pile Driving

1. General

- a) All pile driving hammers should be maintained by the CONTRACTOR in good operating condition and operated according to the manufacturer's recommendations. Jetting of piles will not be allowed.
- b) The hammer should be equipped with a suitable driving head, driving cap, or helmet, which is fabricated or forged of cast steel and shaped and sized to fit the type of pile being driven. A pile cushion to protect the top of the pile from damage during driving should be used.
- c) Modifications to the specified hammer energy, cushion blocks and driving criteria will not be permitted unless the CONTRACTOR submits documented analysis to support the proposed modifications that is acceptable to and authorized by the CR.
- d) Piles shall be driven to the specified tip elevation or driving resistance specified in the design calculations provided by the floating dockage Engineer. During driving, the pile and hammer should be held firmly in alignment by fixed driving leads. Leads should be of sufficient length so that the use of a follower will not be necessary. Pile driving shall be continuous and without interruption for the final ten feet of penetration. Driving should be terminated if an abrupt increase in penetration resistance is encountered or in the event structural damage to the pile is likely to result. Where the specified penetration cannot be achieved by the equipment or driving methods used by the CONTRACTOR, remedial action to achieve the minimum required penetration may include, but is not limited to, pile extraction and drilling, jetting, predrilling, and driving or installation of supplemental piles as approved by the CR.

C. Criteria for Acceptance

1. Location (Horizontal)

- a) The top of the pile shall be within 2 inches of the specified location.
- b) Manipulation of the pile to force it into position will not be allowed.
- c) Piles shall be driven with a variation of not more than 0.10 inch per foot of pile length from the vertical or plumb line.

2. Acceptance

- a) Piles, which are bent, crimped, buckled, leak, or are otherwise unsatisfactory, as herein specified, and which cannot be repaired shall be removed from the site and properly disposed or recycled by the CONTRACTOR. Removed piles shall not be reutilized.
- b) Piles rejected because of misplacement, misalignment, damage or otherwise fail to meet the specified criteria shall be removed by the CONTRACTOR.

- c) Where supplemental piles are required or corrective action is required as a result of pile damage, misplacement, misalignment or other defects the measure taken shall be approved by the CR. Any corrective work shall be performed by the CONTRACTOR at his own expense.

- D. Pile Driving Records: An accurate record shall be kept of the date, time, and equipment details, and number of blows required for each 6 inches of penetration. The record shall include the direction and amount of horizontal displacement from the location specified in the submittals from the dock manufacturer. A copy of the pile driving records and pile locations and deviations will be provided to the CR within three working days following his acceptance of the piles.

- E. Helical Anchor Installation
 - 1. Central Steel Shaft: (Lead and Extension Sections)
 - a) The Helical Pile installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project. The lead section shall be positioned at the location as shown on the working drawings.
 - b) Battered Helical Piles can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required batter angle shall be established. The Helical Pile sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 20 RPM's. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the working drawings. Connect sections together using coupling bolt(s) and nut torqued to 40 ft-lb.
 - c) Sufficient down pressure shall be applied to uniformly advance the Helical Pile sections approximately 3 inches per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths.
 - 2. Termination Criteria
 - a) The torque as measured during the installation shall not exceed the torsional strength rating of the central steel shaft.
 - 3. The minimum installation torque and minimum overall length criteria as shown on the working drawings shall be satisfied prior to terminating the Helical Pile installation.
 - 4. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor shall have the following options:
 - a) Terminate the installation at the depth obtained subject to the review and acceptance of the Owner, or:
 - b) Remove the existing Helical Pile and install a new one with fewer and/or smaller diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new Helical Pile shall be terminated at least (3) three feet beyond the terminating depth of the original Helical Pile. Re-use of Helical Pile shaft material after it has

been permanently twisted or bolt holes have been elongated during a previous installation.

5. If the minimum installation torque as shown on the working drawings is not achieved at the minimum overall length, and there is no maximum length constraint, the Contractor shall have the following options:
 - a) Install the Helical Pile deeper using additional extension sections, or:
 - b) Remove the existing Helical Pile and install a new one with additional and/or larger diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new Helical Pile shall be terminated at least (3) three feet beyond the terminating depth of the original Helical Pile.
 - c) De-rate the load capacity of the Helical Pile and install additional Helical Pile(s). The de-rated capacity and additional Helical Pile location shall be subject to the review and acceptance of the Owner.
 - d) If the Helical Pile is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. The obstruction shall be removed, if feasible, and the Helical Pile re-installed. If the obstruction can't be removed, the Helical Pile shall be installed at an adjacent location, subject to review and acceptance of the Owner.
 - e) If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to proper positioning of the last plain extension section relative to the final elevation, the Contractor may remove the last plain extension and replace it with a shorter length extension. If it is not feasible to remove the last plain extension, the Contractor may cut said extension shaft to the correct elevation. The Contractor shall not reverse (back-out) the Helical Pile to facilitate extension removal.
 - f) The average torque for the last three feet of penetration shall be used as the basis of comparison with the minimum installation torque as shown on the working drawings. The average torque shall be defined as the average of the last three readings recorded at one-foot intervals.
6. Testing
 - a) The Helical Pile shall sustain the compression and tension design capacities with no more than 0.05 inches/kip total vertical movement of the pile-head as measured relative to the top of the Helical Pile prior to the start of testing.
 - b) Failure shall not occur at the 2.0 DL maximum compression and tension test loads. The failure load shall be defined by one of the following definitions – whichever results in the lesser load:
 - 1) The point at which the movement of the Helical Pile tip exceeds the elastic compression/tension of the pile shaft by $0.08 B$, where B is defined as the diameter of the largest helix. (Note that tension loads are limited to the minimum ultimate tensile strength of the coupling joint(s) of the central steel shaft. It is recommended to use the minimum ultimate tensile strengths as published by Chance Civil Construction (shown in Table-1A & 1B of the Appendix).

- II) The point at which the slope of the load versus deflection (at end of increment) curve exceeds 0.05 inches/kip.
- 7. Helical Anchor Installation Records: The Contractor shall provide the Owner copies of field test reports confirming Helical Pile configuration and construction details within 24 hours after completion of the load tests. Formal copies shall be submitted to the CR within three working days following his acceptance of the piles.
- 8. Corrective Action: When a Helical Pile fails to meet the acceptance criteria, modifications shall be made to the design, the construction procedures, or both. These modifications include, but are not limited to, de-rating the Helical Pile load capacity, modifying the installation methods and equipment, increasing the minimum effective installation torque, changing the helix configuration, or changing the Helical Pile material (i.e., central steel shaft). Modifications that require changes to the structure shall have prior review and acceptance of the COMMISSION.

PART 4 - WARRANTY

4.01 GENERAL

A. Floating Dock System:

- 1. Materials and Workmanship
 - a) The Dock Manufacturer shall warrant to the COMMISSION that the materials and workmanship related to the production of the floating dockage system will be free from defects under normal use and service (including wave agitation and ice conditions) for a period of five (5) years from the effective date of the warranty as defined in Paragraph 4.01.C.
 - b) The CONTRACTOR will repair or replace, without cost to the COMMISSION, any part, assembly, or portion thereof, which shall be determined to be the result of defective materials or workmanship on the part of the Dock Manufacturer.
- 2. Anchorage and Dock Installation
 - a) The CONTRACTOR shall warrant to the COMMISSION that the materials and workmanship to fabricate and install the floating dock anchorage and utilities will be free from defects under normal use and service (including wave agitation and ice conditions) for a period of two (2) years from the date of installation.
 - b) The CONTRACTOR will repair or replace, without cost to the COMMISSION, any part, assembly, or portion thereof, which shall be determined to be defective.
- 3. Utility Systems
 - a) The CONTRACTOR shall warrant to the COMMISSION that the materials and workmanship to fabricate and install the floating dock anchorage and utilities will be free from defects under normal use and service (including wave agitation and ice conditions) for a period of two (2) years from the date of installation.

B. Decking:

1. The CONTRACTOR shall warranty the decking material against defects (splitting, crooking, cupping, bowing, twisting, or waning, etc.) due to materials or workmanship, provided recommended maintenance schedules and procedures are followed. The warranty period for Southern Yellow Pine decking materials shall be five (5) years.
2. During this warranty period, deck boards exhibiting defects in excess of the following limits shall be replaced by the CONTRACTOR at no cost to the commission.
 - a) Splits/End Checks: 8 inches max.
 - b) Vertical Deflection (Cupping or Twisting): 1/4 inch
 - 1) This measurement shall be made by placing a 24 inch straight edge perpendicular to the length of the board. The level shall be made to rest on the highest point of the board and shimmed to read level. Vertical deflection shall be measured as the difference between the bottom edge of the straight edge and the board surface. (turning not permitted)
 - c) Presence of knotholes greater than 3/8 inch.
 - d) Waning causing a gap larger than 3/8 inch between boards.
- C. Third Party Manufacturers: Manufacturers of products and materials to be incorporated by the Dock Manufacturer shall certify the warranty for their respective products as shown in the plans, shop drawings and included in the work. This certification shall be required for acceptance of the work and commencement of the Effective Date of Warranty for the Floating Dockage System. Third party warranties are required for the following components/systems.
 1. Dockage System: See Paragraph 4.01.A.1.a
 2. Flotation: The manufacturer shall guarantee the flotation system against defective materials and workmanship for a period of ten (10) years.
 3. Sanitary Pumpout System: The manufacturer shall guarantee the system against defective materials and workmanship for a period of three (3) years.
 4. Any warranties provided by the manufacturer of dock components not specifically mentioned within this specification shall also be certified and provided to the COMMISSION.
- D. Effective Date of Warranty: The effective date of all warranties shall be the date of acceptance by the COMMISSION.

PART 5 - MAINTENANCE AND OPERATIONS MANUALS

- A. General The CONTRACTOR shall furnish the COMMISSION four (4) hard copies and four (4) electronic copies of both the project as-builts, along with an Operation and Maintenance Manual, which shall include instructions and related information for maintaining and operating all aspects of the dockage system, including by not limited to the floating pier system and anchorages including utilities, if applicable (electrical, lighting, water, sanitary pump-out, ice suppression, etc.).

Accompanying the hard copies, the four (4) electronic copies in Adobe PDF format on CD or DVD media. Each disc shall include a single file of the entire manual. The file shall consist of assembled PDF files from each element of the manual. The PDF file shall be comprised of materials directly generated from the original software applications (scans will not be permitted) with bookmark structure matching the tabs and indexing provided in the hard copies.

- B. The CONTRACTOR shall include in the manual, a procedure for floating system winterizing. This procedure shall include disconnection and winterizing of potable water, sanitary sewer suction lines, and proper installation of the ice suppression system specified in Section 02010.
- C. The manual shall include reduced size copies of the final “as-recorded” dock layout and fabrication drawings.

PART 6 - ANNUAL INSPECTION

6.01 GENERAL

- A. The pier manufacturer shall provide a qualified representative to make an annual inspection of the floating pier system every year throughout the warranty period at the expense of the manufacturer.
- B. The annual inspection shall be conducted in the presence of the COMMISSION or CR and a report shall be prepared. The report shall outline the items in need for repair/maintenance. Two (2) copies of the report shall be delivered to the COMMISSION.

END OF SECTION

