
**TECHNICAL SPECIFICATIONS
BULKHEAD REHABILITATION
SECOND INTERIM REPAIRS**

**MIRABAY COMMUNITY DEVELOPMENT
Apollo Beach, Florida**

Prepared For:

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LANGAN

1.0 GENERAL REQUIREMENTS

The District has prepared contract documents for this RFP to solicit pricing information for the proposed Second Interim Repairs presented herein. Langan (the Project Engineer) has prepared these specifications and project drawings for bidding purposes. The term Contractor mentioned throughout this specification refers to the specialty marine contractor selected to perform the work outlined in these construction plans.

The "New Wall" will be the construction of a new bulkhead using fiber reinforced polymer (FRP) sheet piles installed on the waterside of the existing bulkhead and the addition of "Manta Ray" type anchors along with the refurbishment of bulkhead drainage system immediately behind the bulkhead.

- 1.1 The Contractor shall provide all necessary manpower, materials, and equipment to install the following:
 - (1) New Bulkhead using FRP Sheet Piles: 16-ft-long, fiber reinforced polymer sheet piles for the proposed new bulkhead.
 - (2) Existing Tie Rod and Drainage System Enhancement: The existing tie-rod connection along with the first four feet of tie rod length adjacent to the existing bulkhead cap must be protected against corrosion as shown on the contract drawings. In addition, enhancement to the bulkhead drainage system is required throughout the length of proposed bulkhead rehabilitation.
- 1.2 Technical documents including boring profiles obtained from site borings are available from the District during the bidding period for inspection by the Contractor. A Bathymetric Hydrological Survey has been performed by GeoPoint, Inc. in July 2015 and is available from the District.
- 1.3 No guarantee is expressed or implied of the accuracy, reliability, or completeness of such data. No information derived from such logs will in any way relieve the contractor from the responsibility from making his own evaluations, investigations, inspections, and determinations in regards to the surface and subsurface conditions at the site and the requirements of these specifications.
- 1.4 The Contractor shall have at least five years of experience in successful installation of PVC and/or FRP sheet pile bulkheads. The Piling Contractor shall provide a full-time superintendent who is experienced with sheet pile driving during pile installation activities.
- 1.5 The Contractor shall submit a list of successful projects similar in scope to this project, a description of the equipment and materials, and the proposed method of operation to the District for review by Langan and the District's Engineer.
- 1.6 The Contractor shall itemize his proposed costs as outlined in the bidding documents.
- 1.7 The Contractor shall be responsible for ensuring that all construction shall be performed in a safe manner and in strict compliance with all applicable safety standards in accordance with the latest edition of the Federal Occupational Safety and Health act of 1970 and all state local health and safety regulations. The Contractor shall provide his health and safety plan to the District and Bulkhead Engineer at least 7 days prior to beginning work.
- 1.8 Prior to construction of the proposed alternatives, the contractor shall provide staked erosion control along perimeter of the work areas and flotation barrier (turbidity nets) in the water to

- meet all applicable turbidity regulations. The Contractor is responsible for any fines resulting from excessive turbidity releases.
- 1.9 Contractor shall make every effort to minimize disruption (noise, vibration, dust, etc.) to the community properties during construction activities.
 - 1.10 To minimize disturbance, work hours for construction activities shall be between 8:00 am and 6:00 pm Monday through Friday.
 - 1.11 Pre-Construction Conference – Prior to the start of all construction activities, a pre-construction meeting at the site with the Contractor’s superintendent and key personnel and the Project Engineer’s representative to review the project requirements. The District will be notified in writing at least 3 days in advance of the meeting.
 - 1.12 Brief weekly safety meeting chats will be held prior to the start of the work. The meetings will be directed by the Contractor’s Superintendent with input from the Project Engineer representative, as necessary.

2.0 MATERIALS

The approved materials list provides the contractor with minimum product requirements. All materials used on this project must be in accordance with the project drawings and these specifications, unless otherwise approved by the Project Engineer and the District. All materials shall conform to the following:

New Bulkhead Materials:

- 2.1 The new bulkhead sheet piles shall consist of approved fiber reinforced polymer (FRP) resins. Detailed material and procedural requirements are specified in a subsequent section of this specification.
- 2.2 The filler material placed in between the existing vinyl sheet piles and the new FRP sheet piles shall be “flowable fill” that consists of a lean cement and sand mix that can be pumped.
- 2.3 Manta Ray Anchor Systems shall be used to provide additional anchor support, product code MR-SR, or approved equivalent. Manta ray anchors shall consist of hot dipped galvanized steel anchor/shackle assemblies, galvanized thread steel bar assemblies.

Bulkhead Concrete Caps:

- 2.4 The new and refurbished concrete bulkheads shall use “marine concrete” mix that has Type 2 Portland Cement and can reliably achieve compression strengths of at least 5,000 psi at 28 days. Concrete mixes that use corrosion inhibitors must be approved by the Project Engineer.

Steel Reinforcement:

- 2.5 Where steel reinforcement will remain exposed to water and the atmosphere, it shall be hot-dipped galvanized (HDG) minimum G90.
- 2.6 The steel reinforcement bars with a minimum 3 inch clear cover of marine concrete can be regular Grade 60 steel.
- 2.7 Corrosion protection material, where required, shall consist of a galvanized zinc-rich coating.

Enhanced Bulkhead Drainage Materials:

- 2.8 Drainage soils used as backfill behind bulkheads shall be approved environmentally clean free draining coarse-grained sand with less than 5% fine material passing the #200 sieve.
- 2.9 Perforated PVC Pipe for weephole drainage.
- 2.10 Geotextile: Mirafi FW700 or approved equivalent.
- 2.11 Filter Stone shall consist of clean ¾ inch gravel (#57 stone) or approved drainage stone.

3.0 FIBER REINFORCED POLYMER (FRP) COMPOSITE SHEET PILE

This section addresses the specific use of fiber reinforced polymer (FRP) composite sheet piles for the Project.

Note: The material section property values presented herein are based on the following ASTM references. The manufacturer's sheet pile may meet the minimum section property values as per ASTM D638 or ASTM D7290 as shown in Table 1 – Section Properties.

3.1 **References:** American Society for Testing And Materials (ASTM) Test References:

ASTM D3039	Tensile Properties of Plastics
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D7290	Standard Practice for Evaluating Material Property Characteristic Values for Polymeric Composites for Civil Engineering Structural Applications

Terminology: Fiber Reinforced Polymer (FRP) – A thermoset polymer matrix reinforced with a fiber or other material with a sufficient aspect ratio (length to thickness) to provide a discernable reinforcing function in one or more directions.

3.2 **Submittals:** The contractor shall submit to the District and Langan copies of the manufacturer's most recent product brochure for the FRP sheet pile product covered by this specification and five most recent projects where the FRP sheet pile wall was used for bulkhead applications. The submitted FRP sheet pile shall be manufactured in accordance with the requirements of this specification and shall be a standard commercial product. Additional or better features which are not specifically prohibited by this specification, but which are a part of manufacturer's product, shall be included in the FRP sheet pile being furnished.

3.3 **Quality Assurance:** The manufacturer shall have in place a Quality Assurance Program that will ensure the FRP sheet pile is in conformance the intent of this specification. Each delivered section of FRP sheet pile shall be examined by Langan for compliance with the appropriate requirements of this specification. The Project Engineer will have five days from the receipt of delivery to the site to complete the inspection of the FRP sheet pile. This inspection shall encompass all visual examinations and dimensional

measurements. Noncompliance with any specified requirements or presence of one or more major defects preventing or lessening maximum efficiency including significant discoloration shall constitute cause for rejection.

- 3.4 **Polymer (resin)** – The resin for the FRP sheet pile can be polyester, vinyl ester, polyurethane, or a polyester-polyurethane hybrid. The polymer resin system for the FRP sheet pile shall be high performance resins that contain ultra violet (U.V.) stabilizers to provide sufficient resistance to ultra violet light degradation, high heat distortion resistance, high elongation and impact strength and low water absorption. The FRP sheet piles must have a useful life of at least 25 years, be of merchantable quality, and be fit for use in the District’s Master Project.
- 3.5 **Reinforcement** – The glass fiber reinforcement shall be in the form of continuous roving, woven roving or stitched fabrics, and surface matting. The finished FRP sheet pile product shall meet the minimum section properties shown in Table 1.
- 3.6 **General Configuration** – The FRP sheet pile shall be pultruded Z-shaped sections with a ball and socket interlock with nominal dimensions shown in Table 2. The FRP sheet pile shall be gray in color unless otherwise approved by the Project Engineer.
- 3.7 **Defects** – The sheet pile transported to the project shall be free from visible crack, indentations and other noticeable defects.
- 3.8 **Sheet Piles** - Approved FRP sheet piles include Everlast Evercomp 26.1 and Creative Pultrusions SuperLoc 1580 Series or an equivalent approved by the Project Engineer.
- 3.9 **Manufacturing Process:** FRP sheet pile shall be manufactured using the pultrusion process. Pultrusion is defined as the continuous processing of raw materials by pulling resin-rich reinforcements through a heated steel die to form profiles of constant cross section of continuous length.
- 3.10 **Properties:**

Table 1 – Section Properties

Property	Minimum Value
Average Full Section Modulus of Elasticity (ASTM D638)	4,000 ksi
Characteristic Value Full Section Modulus of Elasticity (ASTM D7290)	3,460 ksi
Moment of Inertia	52 in ⁴ /ft
Section Modulus	13 in ³ /ft
Cross Sectional Area	4.9 in ² /ft

Table 2 – Dimensions/Tolerances and Weight

Specification	Minimum Value
Length	16 ft ⁽¹⁾
Width	18 in ⁽²⁾
Depth	8 in
Thickness	0.25 in
Weight (pound per linear ft - per vertical ft)	6 lbs/ft ⁽³⁾

Notes:

- (1) Minimum embedment requirement is 10 ft below the existing mud lines adjacent to the existing vinyl sheet pile walls at the project.
- (2) Measured from center of interlock to center of interlock.
- (3) The weight of sheet pile is approximate and expressed in pounds per linear ft per vertical ft.
- (4) The manufacturer’s sheet pile may meet the minimum value as per ASTM 638 or ASTM D7290.

3.11 Shipping and Handling

3.11.1 The FRP sheet pile manufacturer/ supplier shall have no more than 30 days from the time the Contractor places their order to delivery to the site.

3.11.2 FRP sheet pile shall be shipped in such a manner as to minimize scratching and damage. FRP sheet pile shall be delivered such that they can be moved using traditional lifting and handling methods.

3.12 Installation

3.12.1 Installation shall be in accordance with Project Engineer’s embedment and driving requirements as well as manufacturer’s guidelines.

3.12.2 FRP sheet piles to be installed at the project must have a minimum length of 16 ft such that a minimum embedment length of 10 ft below the existing mud lines at the project can be achieved.

3.12.3 FRP sheet pile shall be installed using traditional driving methods including vibratory hammers or approved impact hammers.

3.12.4 Where localized hard or impenetrable zones prevent traditional sheet piling installation without sheet pile damage, “prepunching” of the alignment shall be performed using a steel sheet pile with similar cross-sectional dimensions to the selected FRP sheet pile. The prepunching and FRP sheet pile reinstallation shall be observed and approved by Langan’s field engineer. A unit cost for this item is required.

3.13 Cutting and Drilling – FRP sheet pile can be cut using carbide edged masonry blades and drilled with carbide or cobalt tipped bits. Any required sheet pile cutting shall be approved by Langan’s field engineer.

3.14 Workmanship, Finish, and Appearance – FRP sheet pile shall be furnished in accordance with this specification shall be an acceptable match to approved samples in color and surface appearance. The product shall be free of defects that adversely affect performance or appearance.

- 3.15 The interlocking system of the FRP sheet pile must be capable of interlocking with the Everlast Evercomp 26.1 sheet pile and Creative Pultrusions Superloc 1580 Series, which have been installed for the project emergency repairs.
- 3.16 The quantity of FRP sheet pile to be paid for under the work specified will be the number of linear feet of at least 16 ft long, 18-inch-wide installed in accordance with the project bulkhead construction plans and this specification, approved by the Project Engineer.
- 3.17 The unit price bid per linear feet of at least 16 ft long and 18-inch-wide FRP sheet pile, meeting the properties in this specification and on the project drawings, shall include all costs for material and freight to the site.

4.0 MINIMUM PROCEDURES AND REQUIREMENTS FOR CONSTRUCTION

This section describes the minimum procedures and inspection requirements for the bulkhead repairs.

- 4.1 The Contractor shall provide pricing in accordance with the requirements of the project documents, project drawings and these specifications for the following:
 - (1) New Bulkhead using FRP Sheet Piles with Refurbished Cap: 16-ft-long, fiber reinforced polymer sheet piles for the proposed new bulkhead.
 - (2) Existing Tie Rod and Drainage System Enhancement: The existing tie-rod connection along with the first four feet of tie rod length adjacent to the existing bulkhead cap must be protected against corrosion as shown on the contract drawings. In addition, enhancement to the wall drainage system is required throughout the length of proposed bulkhead rehabilitation.
- 4.2 All geotechnical related construction activities (i.e. sheet pile installation, Manta Ray anchor installation, etc.) will be monitored full time by the Bulkhead Project Engineer. The Bulkhead Project Engineer will also frequently monitor and document the construction of structural components such as steel reinforcement assembly, concrete and flowable fill placement, and backfill placement. The Contractor shall assist the Bulkhead Project Engineer, as requested, in these inspection activities.
- 4.3 Concrete, Compression Testing: All placed concrete for the refurbished caps shall be sampled and compression tested by an independent materials testing laboratory.
 - 4.3.1 Upon delivery, 6 representative concrete cylinders will be collected for compression testing.
 - 4.3.2 Placed concrete will be sampled up to 50 cubic yard intervals or at least once a day during concrete placements at the Project Engineer's discretion.
 - 4.3.3 The samples will be cured in accordance with ASTM C-511-06 unless otherwise noted.
 - 4.3.4 Compression tests will be performed on individual cylinders at 3, 7 and 14 days. At 28 days two cylinders will be tested. One cylinder will be held for 56 days in case the 28 day test results do not meet the project concrete compression strength requirements.

- 4.4 Protection of Persons and Property: During all construction activities, Contractor shall provide protection, which shall include, but not limited to:
- 4.4.1 Installation and maintenance of fences, barricades, warning signs, as required, that establishes a safe working environment for field personnel and residents.
 - 4.4.2 Protection of residential structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations. Repair, replace, or otherwise restore such damaged services and/or construction to a condition as good as prevailed at the time work started, and without additional compensation.
 - 4.4.3 Weep holes and the wall drainage enhancement shall be constructed in accordance with project drawings.
 - 4.4.4 The existing drainage fill adjacent to the bulkhead shall be removed and replaced with suitable drainage material as shown on the project drawings. Small excavators weighing not more than 2,000 lbs may be used adjacent to the existing bulkheads with the Bulkhead Project Engineer's approval.
 - 4.4.5 Concrete and reinforcing steel placed for cap refurbishment and tie rod restoration, as required, shall be performed in accordance the project drawings and these specifications.
- 4.5 **Backfilling:** The existing near surface soil that underlies the upland swale is not a suitable quality fill material for wall drainage purposes. Backfill material should be approved imported, environmentally and geotechnically clean, inorganic granular material with less than 5% fines passing the #200 sieve and no particles larger than three inches. All backfill shall be placed and hydraulically compacted.
- 4.6 **New Bulkhead:**
- 4.6.1 The new bulkhead shall be constructed with a new FRP sheet pile, new concrete cap that envelopes the existing cap, new Manta Ray anchors and refurbished tie rod restoration, as required, in accordance with the project drawings and these specifications.
 - 4.6.2 The Contractor shall not install more than 500 linear feet of inter-connected sheet piling without approved bracing and pouring flowable fill between the new and old sheet piles.
- 4.7 **Cap Formwork:** The Contractor is solely responsible for the construction and safety of erected formwork.
- 4.7.1 All materials used for formwork should be installed to correct dimensions that assure proper alignment. Level guides shall be installed for the level maintenance of concrete.
 - 4.7.2 Formwork should be watertight to avoid any slurry leakage.
- 4.8 **Steel Reinforcement:** All structural steel and hardware must be prefabricated as described in this specification.

- 4.8.1 Prefabricated steel shall be placed in accordance with the project drawings.
- 4.8.2 Approved steel wire shall be used to tie reinforcement bars. Spacer blocks of approved type will be used to maintain minimum concrete cover as per the project drawings.
- 4.8.3 All embedment or inserts related to utility connection and drainage shall be placed as per project drawings.
- 4.8.4 All steel reinforcement must be inspected by the Bulkhead Project Engineer prior to concrete pouring and to ensure that it is free from all oil, dust and deleterious materials. After the completion of installation of steel reinforcement and pipes (tied to the reinforcement) inserts inspection an approval shall be done prior to concrete pouring.
- 4.8.5 Storage and Handling: All purchased reinforcement and steel must meet the project requirements. Storage and handling must follow standard practice. On receipt of the material on site the reinforcement shall be checked against documentation to ensure compliance. Quality of the reinforcement shall be checked before it is stored on site. Keep material off the ground by supporting by timber / concrete pad at all times. Handle and stack material to prevent deformation.
- 4.8.6 Cutting and Bending – Cutting and bending of steel reinforcement shall be done in accordance with the project drawings and bar bending schedule. The bar will be cut with a shear line cutting machine. For stirrups and cranked bars, the cut bars will be taken to the bending machine and bend as per shop drawings.

4.9 Restoration of Landside Swale and Docks

- 4.9.1 Upon completion of the drainage materials placement as shown in the Project drawings, the Contractor shall restore all irrigation and electrical lines to their original condition along with the sodded swale surface.
- 4.9.2 Conduits that will pass through the bulkhead, which required power to feed utility lines from landside utility supply lines and docks, must be approved by the Project Engineer and the District.
- 4.9.3 Any docks impacted by the construct a new or refurbished bulkhead caps, shall be repaired and restored to their original condition.