Gulf Synthetics
Composite Sheetpile Specification

(Note: Italics means engineer must choose one of the material options presented as a primer. Additional evaluation and detailing will likely be required to determine the fitness for use of the various products presented.)

1. Materials

1.1 Gulf Synthetics Composite Sheetpile - Sheetpile profile shall be manufactured with an interlocking feature that ensures adjacent panels maintain alignment. The sheetpile material shall be an engineered composite material pultruded from a resin and glass reinforcement fiber matrix having the following properties. The sheetpile shall be free from visible cracks and other injurious defects. Composite sheetpile other than that from Gulf Synthetics may be used if it meets the following properties and is approved by the engineer in writing.

1.1.1 Resin System – shall be a high performance PUR™ Polyurethane resin, which exhibits low water absorption, high UV resistance, high heat distortion temperature, high elongation, and high impact strength. Resin system's chemistry must be a 100% Polyurethane. Hybrid Polyurethane resin or Polyester based resin systems are not acceptable.

1.1.2 Minimum average physical properties (unless otherwise noted) of the finished sheetpile material shall be:

PURLoc 4.3 Composite Sheetpile			
Properties	**Values**		**Test Method**
Allowable Moment	43,792 ft-lb/ft	194,797 m-N/m	
Recommended Moment	14,597 ft-lb/ft	64,931 m-N/m	
Modulus of Elasticity-Longitudinal Direction	6.77E+06 psi	47,574 MPa	ASTM D638
Modulus of Elasticity-Transverse Direction	2.50E+06 psi	17,237 MPa	ASTM D638
Flexural Modulus-Perpendicular	2.91E+06 psi	20,064 MPa	ASTM D790
Flexural Strength-Perpendicular	3.46E+04 psi	239 MPa	ASTM D790
Flexural Modulus-Parallel	4.99E+06 psi	34,405 MPa	ASTM D790
Flexural Strength-Parallel	1.16E+05 psi	802 MPa	ASTM D790
Short Beam Shear-Perpendicular	4,210 psi	29 MPa	ASTM D2433
Short Beam Shear-Parallel	5,958 psi	41 MPa	ASTM D2433
Tensile Strength-Parallel	6,780 psi	47 MPa	
Compressive Modulus-Perpendicular	2.45E+06 psi	16,892 MPa	ASTM D6641

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PURLoc 4.3 Composite Sheetpile			
Properties	**Values**		**Test Method**
Compressive Strength-Perpendicular	2.71E+04 psi	187 MPa	ASTM D6641
Compressive Modulus-Parallel	6.41E+06 psi	44,195 MPa	ASTM D6641
Compressive Strength-Parallel	1.35E+05 psi	930 MPa	ASTM D6641
Width (effective)	18.0 in	457 mm	
Depth of Section	8.0 in	204 mm	
Web Thickness	0.25 in	6.4 mm	
Stiffener Thickness	0.33 in	8.4 mm	
Flange Thickness	0.40 in	10.2 mm	
Moment of Inertia	52.0 in^4/ft	7,101 cm^4/m	
Section Modulus	13.0 in^3/ft	699 cm^3/m	
Weight	6.1 lb/ft	9.08 kg/m	
Standard Color	Light Grey		
Structural Ribs	Yes		
Reinforced Corners	Yes		
Material	Fiberglass Reinforced **PUR** Composite		

No warranty of any kind is made as to the suitability of Gulf Synthetics products for a particular application or the results obtained therefrom. Gulf Synthetics recommends that you consult with a local professional (qualified engineer and/or contractor) as to the suitability for your particular application. Gulf Synthetics also recommends application of ASTM D7290 for determining design values as standard operating procedure. Please contact Gulf Synthetics should assistance be required for determining these values.

1.2 Wales - wales for support of composite sheetpile shall be one of the following:

- *FRP channel as noted on the plans*
- *Double Steel Channel as noted on the plans and coated with 21 POLYPLUS™.*
- *SYP Timber as noted on the plans and coated with 21 POLYPLUS™.*

1.3 Structural Cap - top cap for support of composite sheetpile shall be one of the following:

- *FRP cap as noted on the plans*
- *Steel Channel as noted on the plans and coated with 21 POLYPLUS™.*
- *SYP Timber as noted on the plans and coated with 21 POLYPLUS™.*
- *CIP Concrete as noted on the plans*

1.4 Tie-back System Anchors used to tieback the bulkhead shall be as noted on the drawings. Otherwise, the following anchor types are acceptable:

- *Platipus Earth Anchors*
- *Chance Earth Anchors*
- *Reinforced Concrete Deadmen*
- *FRP deadman as noted on the plans*
- *Gulf Synthetics sheetpile with FRP channel stiffener as noted on the plans*

1.5 Tie Rods and Miscellaneous Hardware

- *All steel not entirely encased in concrete shall be either all stainless steel(SS 304 or SS 316) or all hot dip galvinized(A 136) steel(A36 or 572). This includes tie rods, all threads, couplers, washers, nuts, carriage bolts, and lag screws. No mixing of steel types will be allowed.*
- *Composite(FRP vinylester resin) tie-rod having ultimate thread/nut/washer/epoxy assembly capacity of 10,000 lbs(based on double nut assembly) per ASTM D 6638 modified. Also, ultimate flexural stress of 50,000 psi and maximum water absorption of 1%(ASTM D-570).*
- *Composite (FRP vinylester resin) tie-back strip having ultimate tensile stress of 20,000 psi.*

1.6 Backfill Backfill material placed behind the sheetpile shall be free draining and restricted to GW, GP, SW, or SP per ASTM D-2487. Other backfill materials may be used if approved by the engineer or if noted otherwise on the plans.

2. Delivery and Storage

Upon delivery of materials to the site, contractor shall visually inspect all materials for defects or damage. If serious defect or damage is detected, contractor shall notify engineer immediately. Store bundled sheetpile on relatively level surface with a slight pitch to allow water to drain. Contractor should not break bundled sheetpile until ready for immediate installation.

3. Submittals

3.1 Complete descriptions of sheetpile driving equipment including hammers, extractors, protection caps and other installation appurtenances shall be submitted for approval prior to commencement of work.

3.2 Material Certification - manufacturer shall provide Letter of Certification from a registered professional engineer assuring that the sheetpile meets requirements set forth in Section 1.1.

4. Installation

4.1 Install driving guide, template, or wale system to aid in driving a straight and plumb wall. A “two level” template as well as front and rear wale/bracing system is strongly suggested for tough and/or deep driving situations.

4.2 Drive sheetpile(preferably in pairs) by “Driving in Steps” or “Gang Driving”. Direction of installation should be with the male side of the sheetpile when possible. Mandrel, helmet, or drive shoes may be required if driving through hard soil strata or obstructions. Water jet by displacing of soil shall only be used with non-cohesive soils(sands and gravels). Water jet shall not be used if driving through clay, silts, or immediately adjacent to an existing structure without the written approval from the engineer. Water may be introduced to induce lubrication and liquefaction during installation. It is very important that contractor drive sheetpile to required embedment depth. Under no circumstances shall the contractor cut-off or install shorter sheetpile without written authorization from engineer or the owner. Adequate precautions shall be taken to insure that

piles are driven plumb. Sheetpile shall not be driven more than 1/2-inch per foot out of plumb in the plane of the wall, nor more than 1/16- inch per foot “out” of plumb perpendicular to the plane of the wall, nor more than 1- inch per foot “in” of plumb perpendicular to the plane of the wall.

4.3 Piles driven out of interlock with adjacent piles or otherwise damaged shall be removed and replaced by new piles at the contractors expense

4.4 Install wales, tie rods, and deadman as noted on the project plans.

4.5 Install drainage system and weep holes(if required).

4.6 Backfill behind sheetpile in level compacted lifts (12” maximum lift thickness). Compaction of backfill shall be 95% based on ASTM D-698. Maintain heavy equipment at least four feet from the back of the sheetpile.

5. Payment

Payment of composite sheetpile wall shall be based on linear foot of bulkhead acceptably installed. Payment shall be full compensation for supply and installation of sheetpile, wales, cap, hardware, tie rods, anchoring system, and backfill.