Make this Section a part of the Standard Specifications:

"SECTION 510 – SCOUR PROTECTION AND REVETMENT

510a – CLASS VII RIPRAP ROCK ARMOR STONE,
510b – CLASS III PARTIALLY GROUTED RIPRAP,
510c – CORE LAYER
510d – ROCK FILLER MATERIAL (KYOWA BAGS)
510e – ROCK FILLER MATERIAL (TRITON MARINE MATTRESS)
510f – KYOWA BAGS
510g – TRITON MARINE MATTRESS

510.01 Description. This section describes the scour protection and revetment design that will be used along the north and south embankments. A combination of foundation material, Class VII riprap armor stones, Class II partially grouted riprap, and a core layer (as needed) will be installed. Kyowa Bags (or approved equal) and Triton Marine Mattress (or approved equal) will be installed as the foundation material. The scour protection shall be installed to protect the embankments at the north and south abutments from riverine scour during storms and along the south shoreline to protect against oceanographic storm events and wave induced scour.

510.02 Materials. All rock material shall conform to the requirements of Material Specification 523, Rock for Riprap and shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines, and other material not meeting the required gradation limits.

The contractor shall designate in writing the source from which rock material will be obtained and submit documentation for approval by the engineer that the material meets contract requirements. Rock from approved sources shall be excavated, selected, and processed to meet the specified quality and grading requirements at the time the rock is installed.

All stones shall have a minimum specific gravity of 2.40 and shaped midway between a sphere and a cube.

510.02a The Class VII Riprap Rock Armor Stones shall have the following minimum and maximum allowable particle sizes in inches

Nominal Riprap Class by Median Particle Diameter		d_{15}		d_{50}		d_{85}		d_{100}
Class	Diameter	Min.	Max.	Min.	Max.	Min.	Max.	Max.
VII	24 in.	14.5	21.0	23.0	27.5	31.0	37.0	48.0

Nominal Riprap Class by Median Particle Weight		W_{15}		W_{50}		W_{85}		W_{100}
Class	Weight	Min.	Max.	Min.	Max.	Min.	Max.	Max.
VII	1/2 ton	260	740	950	1700	2500	4100	9000

510.02b The Class III Partially Grouted Riprap shall have the following minimum and maximum allowable particle sizes in inches

Nominal Riprap Class by Median Particle Diameter		d_{15}		d_{50}		d_{85}		d_{100}
Class	Diameter	Min.	Max.	Min.	Max.	Min.	Max.	Max.
III	12 in.	7.3	10.5	11.5	14.0	15.5	18.5	24.0

Nominal Riprap Class by Median Particle Weight		W_{15}		W_{50}		W_{85}		W_{100}
Class	Weight	Min.	Max.	Min.	Max.	Min.	Max.	Max.
III	150 lb	32	93	120	210	310	510	1100

Grout shall be composed of a Portland Cement based grout with a minimum 28-day compressive strength of 3000 PSI. See the recommended concrete mix ratio below for one cubic yard:

Portland Cement	740 to 760 lbs
Fine Aggregate (sand)	1,180 to 1,200 lbs
¼" Crusher Chips (Gravel)	1,180 to 1,200 lbs
Water	420 to 450 lbs
Air Entrained	5 to 7%

Grout shall be placed by hand or using a hose or tremie method and shall not segregate when being applied. If using a hose or tremie method, ensure the nozzle is sufficiently sized to fit into the void spaces for proper placement of

grout. Fill the voids between stones a depth of 1/3 of the total void space thickness (1/3 the thickness of the riprap layer) as measured from the exterior surface. Exterior grout surfaces shall be broom finished to maintain a smooth exterior finish between stones.

510.02c The Core Layer shall be well graded with a maximum dimension of 6 inches (6-inch Minus).

510.02d The Kyowa Bag Rock Filler Material shall be well graded with a maximum dimension of 6 inches and a minimum dimension of 3 inches. If using a different product, follow manufacturers recommendations for rock sizes.

510.02e The Triton Marine Mattress Rock Filler Material shall be well graded with a maximum dimension of 6 inches and a minimum dimension of 2 inches. The average stone size shall not be greater than 4 inches. If using a different product, follow manufacturers recommendations for rock sizes.

510.02f The Kyowa Bag (or approved equal) Material shall have the final fill dimensions of 6 feet diameter by 1.5 feet high. The netting material shall be capable of permanently encasing the filler rock, able to be lifted in place, suitable for use in a marine and riverine environment, and capable of withstanding water velocities of 10 ft/s.

510.02g The Triton Marine Mattress (or approved equal) Material shall be made of High Density Polyethylene (HDPE) fabric material stitched into rectangle shapes as shown on the plans with individual compartments that will be filled with the filler stone. A geotextile fabric shall be incorporated along the bottom surface with an overlapping flap that can placed under the adjacent mattress for continuity. The mattresses shall be made according to the dimensions showed, then filled with the filler stones and closed, then lifted using a spreader bar and laid in place. The mattress shall be capable of permanently encasing the filler rock, able to be lifted in place, used in a marine and riverine environment, and suitable as a foundation layer for the Class VII riprap armor stones.

510.03 Construction. The work shall consist of the construction of a stone revetment scour protection and shoreline protection, including Class VII riprap armor stones, Class III partially grouted riprap, geotextile fabric, and a core layer (if situated on soil and not hard material) which is additionally wrapped in a geotextile fabric. The Kyowa Bags (or approved equal) and the Triton Marine Mattress shall be used as the foundation material that the Class VII riprap will be place on.

510.03a The Class VII riprap shall be placed by equipment to the depth and height specified. It shall be installed to the full course thickness in one

operation and in such a manner as to avoid serious displacement of the underlying material. The Class VII riprap shall be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed along the exterior surfaces and firmly in contact one to another with the smaller rocks laid in the interior of the revetment. Spalls shall be used to fill the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface. The Class VII riprap shall be placed in a manner to prevent damage to structures. Hand placing is required as necessary to prevent damage to any new and existing structures.

510.03b The Class III partially grouted riprap shall be placed by equipment or by hand to the depth and height specified. It shall be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The Class III riprap shall be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed along the exterior surfaces and firmly in contact one to another with the smaller rocks laid in the interior of the revetment. Spalls shall be used to fill the voids between the larger rocks. Once the stones are in place, the top 1/3 of the void spaces shall be grouted. Do not fully grout the all the void spaces. This ensures that the Class III riprap will be "self-healing" if it becomes damaged or undermined. The grout shall be composed of a Portland Cement base with a minimum 28-day compressive strength of 3000 PSI.

510.03f The Kyowa Bags (or approved equal) shall be filled by the means and methods specified by the manufacturer. It shall also be filled to recommended weight using the specified rock material. Once filled the bags shall be lifted and installed as shown on the plans for lift 1 and lift 2.

510.03g The Triton Marine Mattress (or approved equal) shall be filled by the means and methods specified by the manufacturer. It shall also be filled to recommended weight using the specified rock material. Once filled the mattresses shall be lifted and installed as shown on the plans

A geotextile fabric shall be placed under the Class VII and Class III riprap and on the prepared subgrade surface as specified. Compaction of filter or bedding aggregate is not required, but the surface of such material shall be finished reasonably smooth and free of mounds, dips, or windrows.

See the plans for specific locations.

Submittals.

(A) Submit (6) sets of material gradation for the Class VII Riprap Armor Stone, the Class III Partially Grouted Riprap, the Core Layer, the Filler Rock for the Kyowa Bags and the Triton Marine Mattress for approval by

the Engineer.

(B) Submit (6) sets of manufacturers cut sheets and product specifications for the Kyowa Bags for approval by the Engineer.

(C) Submit (6) sets of manufacturers cut sheets, product specifications, and shop drawing for the Triton Marine Mattress for approval by the Engineer.

510.04a Measurement.

510.03a&b&c The Class VII, Class III, and Core Layer rock material quantities will be computed to the nearest 0.1 ton by actual weight. For each load of rock material placed as specified, the contractor shall furnish to the engineer a statement-of-delivery ticket showing the weight to the nearest 0.1 ton. The geotextile fabric shall be incidental to this work.

510.03f&g The Kyowa Bags and Triton Marine Mattress shall be measured as each and as fully installed and accepted by engineer.

510.05a Payment. Payment is made at the contract unit price for each type of rock material or each as specified above. Such payment is considered full compensation for completion of the work.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	**Pay Unit**
Class VII Riprap Rock Armor Stone	Ton
Class III Partially Grouted Riprap	Ton
6 Inch Minus (Core Layer)	Ton
Kyowa Bags	Each
Triton Marine Mattress	Each”

END OF SECTION 510