STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

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NEWINGTON, CONNECTICUT 06131-7546

Phone: 860-594-3128

January 8, 2013

Subject: Project No. 92-549
F.A.P. No. N/A
Town of New Haven: Sea Street Salt Storage Facility.

NOTICE TO CONTRACTORS:

This is to notify all concerned and especially the prospective bidders that the bid opening for the subject project is still scheduled for January 16, 2013 at 2:00 P.M. in the Conference Room of the Department of Transportation Administration Building, 2800 Berlin Turnpike, Newington, Connecticut.

Addendum No. 1 is attached and can also be obtained on the Statewide Contracting Portal at http://www.biznet.ct.gov/scp_search/BidResults.aspx?groupid=64

This addendum is necessary to revise contract documents and answer project questions.

Bid Proposal Forms (0092-0549.EBS file and amendment file 0092-0549.00# if applicable) are available for those bidders that have received approval from the Department to bid on the subject project.

To retrieve the official Bid Proposal Forms, please download the electronic bid proposal file and amendment files, if applicable at https://www.bidx.com.

The Department has established a general mailbox to receive contractor questions. Please send all future questions to **DOTContracts@ct.gov**

H. J. Emond
For: Gregory D. Straka
Contracts Manager
Division of Contracts Administration

JANUARY 8, 2013
SEA STREET SALT STORAGE FACILITY
STATE PROJECT NO. 92-549
CITY OF NEW HAVEN

ADDENDUM NO. 1

SPECIAL PROVISIONS

NEW SPECIAL PROVISIONS

The following Special Provisions are hereby added to the Contract:

- ITEM #0969049A - DOCUMENT CONTROL SPECIALIST (MINIMUM BID)
- CSI SPECIFICATION SECTION 033000 - CAST-IN-PLACE CONCRETE

REVISED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety and replaced with the attached like-named Special Provisions:

- SECTION 1.05 - CONTROL OF THE WORK
- ITEM #0000172A - ROADWAY DEICING SYSTEM
- ITEM #0507171A - HYDRODYNAMIC SEPARATOR
- CSI SPECIFICATION SECTION 061500 - WOOD DECKING
- CSI SPECIFICATION SECTION 061800 - GLUED-LAMINATED CONSTRUCTION
- CSI SPECIFICATION SECTION 073129 - WOOD SHINGLES AND SHAKES

CONTRACT ITEMS

NEW CONTRACT ITEMS

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
0822001	TEMPORARY PRECAST CONCRETE BARRIER CURB	L.F.	450
0969049A	DOCUMENT CONTROL SPECIALIST (MINIMUM BID)	L.S.	L.S.

REVISED CONTRACT ITEM

ITEM NO.	DESCRIPTION	ORIGINAL QUANTITY	REVISED QUANTITY
0212000A	SUBBASE	790 C.Y.	1050 C.Y.

DELETED CONTRACT ITEM

ITEM NO.	DESCRIPTION	ORIGINAL QUANTITY	REVISED QUANTITY
0821176	PRECAST CONCRETE BARRIER CURB (27" X 42")	450 L.F.	0

PLANS

NEW PLAN

The following Plan Sheet is hereby added to the Contract:

STANDARD SHEET HW-822-01 TEMPORARY PRECAST CONCRETE BARRIER CURB

REVISED PLANS

The following Plan Sheet is hereby deleted and replaced with the like-numbered Plan Sheet:

02.01.A1

05.06.A1

PERMIT

The following Permit is hereby added to the Contract:

- FLOOD MANAGEMENT CERTIFICATION

QUESTIONS & ANSWERS

Q1. Please provide a detail for Item #0821176 Precast Concrete Barrier Curb (27" x 42").

A1. "Item #0821176 - Precast Concrete Barrier Curb (27" x 42")" will be replaced with an equivalent length of "Item #0822001 - Temporary Precast Concrete Barrier Curb", and the standard drawing entitled "HW-822-01 - Temporary Precast Concrete Barrier Curb" has been included in Addendum 1.

Q2. I am trying to get to the concrete specifications for project 92-549. I have looked through the specs here (http://www.biznet.ct.gov/scp_search/BidResults.aspx?groupid=64) and in Item #0921029A – Concrete Apron it states that Materials comply with CSI Division 03, Section 033000, "Cast-in-Place Concrete". I can find no such section in this document.

A2. The CSI specification "033000 Cast In Place Concrete" was inadvertently omitted from the original contract documents. It has been included in Addendum No. 1

Q3. The Asbestos and Lead Abatement specifications denote work to be completed at Salt Sheds #1 and #2, yet the plans do not have any designations for the existing salt sheds. Please advise.

A3. Refer to Special Provision for "Item #0999001A - Disposal of Buildings", Article 9.99.03 – Construction Methods, (2) Disposal of Buildings Provisions, in bold on top of the 4th page of the special provision (Pg. 279 of the Contract), describes each building to be demolished: Salt Shed No 1 & Storage Shed No 2, which states Salt Shed No. 1 is wood framed, and Storage Shed No. 2 is steel/concrete block with asphalt roof. Then, refer to Site Demolition Plan, Sheet No. 04.02, which has a note in the middle of the plan: "Remove Building and Exterior Bracing"

pointing to “Shed”, which is Salt Shed No. 1, and a note above that: “Remove Building” pointing to “Conc. Block Building”, this is Storage Shed No. 2.

Q4. Are the laminated beams/gabled ends to be Pressure Treated?
Is the siding to be fire treated/pressure treated?
Is the tongue & groove lumber to be pressure treated?

A4. Yes the laminated beams/gabled ends to be Pressure Treated. Refer to revised CSI Specification “SECTION 061800 - GLUED-LAMINATED CONSTRUCTION”, Article 2.1 STRUCTURAL GLUED-LAMINATED TIMBER, Subarticle “F”. Yes the siding to be fire treated/pressure treated. Refer to revised CSI Specification “SECTION 073129 - WOOD SHINGLES AND SHAKES”, Article 2.2 WOOD TREATMENTS, Subarticle “A”. Yes, the tongue & groove lumber to be pressure treated. Refer to revised CSI Specification “SECTION 061500 - WOOD DECKING”, Article 2.1 LUMBER, GENERAL, Subarticle “D”.

Q5. Please provide a subbase or processed aggregate base detail for the asphalt paving in the salt shed building. Sheet 05.03 shows it’s a bituminous concrete pavement with membrane, if we are to use the detail on sheet 05.07 with 14” subbase then the quantity provided in the bid item 790 cy wont be sufficient. Please clarify.

A5. The quantity for “Item #0212000A - Subbase”, has been revised to 1050 c.y. (increased by 260 c.y.). The original quantity was inadvertently left out the area within the shed.

Q6. Item #0507171A Hydrodynamic Separator, no project specific design data is provided in Form A, only sample data. Project specific design data is required to properly size the Hydrodynamic Separator.

A6. The special provision for “Item #0507171A - Hydrodynamic Separator” has been revised to include design data.

Q7. Please clarify the concrete strength to be used for this project. On sheet SS-005 Design Construction Parameters item 3b it calls for 5000 psi concrete, under Cast-In-Place Concrete item 5a it calls for class F concrete.

A7. Class F Concrete typically has a minimum strength of 4,000 psi but in this project, since the concrete will be exposed to salt, we are specifying a 5,000 psi strength concrete. A concrete class is not indicative of its strength, but rather the composition of the size of aggregates.

Q8. Could we use an equal for Type "A" light fixture?

A8. Yes. An approved equal fixture is acceptable.

Q9. Who is responsible for removing the existing wooden utility poles from jobsite?

A9. The Contractor shall coordinate pole removal with the utility company. The UI Pole (UI 9857) shown on the plans to be removed shall be removed by UI as indicated on Sheet No. 04.02. All other poles shown to be removed shall be removed by the contractor.

Q10. Drawing SS-005 calls for a preload for the proposed salt shed location. I am assuming this is the same as surcharging the area. Can we use the sand pile that needs to be removed to preload (surcharge) the area and bring in any additional that may be required?

A10. The soil preload installation will be accomplished by Department Maintenance forces using the sand pile prior to Notice to Proceed of the contract. The preload will be in place at the time of Notice to Proceed.

The Bid Proposal Form has been revised to reflect these changes.

There will be no change in the number of calendar days due to this Addendum.

The foregoing is hereby made a part of the contract.

SECTION 1.05 - CONTROL OF THE WORK

1.05.02--Plans, Working Drawings, and Shop Drawings:

Delete the entire subsection entitled "2. Working Drawings:"

Delete the entire subsection entitled "3. Shop Drawings:"

1.05.08 – Schedules and reports

After the 1st sentence add the following:

The Contractor shall prepare the project schedule, including any revisions and monthly updates thereto, using the schedule module within PMWEB. PMWEB is the document/schedule control system established and maintained by the Department. Please refer to Item No. 0969049A – Document Control Specialist (Minimum Bid) for additional information regarding PMWEB. The Contractor's scheduler shall be designated as one of the five personnel to be granted access to the system.

ITEM #0000172A - ROADWAY DEICING SYSTEM

Description:

Under this item, the Contractor shall selectively demolish the existing calcium chloride storage and dispensing system and construct calcium chloride storage and dispensing system as shown on the plans and described herein.

The Owner will provide the following materials to the Contractor on the Project Site to incorporate into the work:

1. Tank support structure consisting of metal beam rail and stone.
2. Pumps, pipe, pipe fittings, and related accessories noted on the plans as "existing."

The Contractor shall submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS:

1. Product Data: For each type of product indicated. Include rated capacities of selected model clearly indicated, and installation and start-up instructions.
2. Shop Drawings: Include wiring diagrams that detail wiring for power, signal, and control systems and differentiate between portions of wiring that are factory-installed and portions to be field-installed.

Materials:

Aboveground Tank: Double-wall, 5,000 gallon primary capacity, for the storage of calcium chloride solution at atmospheric pressure.

Basis of Design: 5,000 Gallon Captor Containment System as manufactured by Snyder Industries, Inc. (www.snydernet.com), or an approved equal. Tank shall be:

1. Design: Industrial, upright, double wall, flat bottom storage tank assembly designed for above-ground, vertical installation, capable of containing calcium chloride solution at atmospheric pressure, specific gravity of 1.5.
2. Material: Linear high density polyethylene, containing a minimum U.V. 8 stabilizer for long-term outdoor service.
3. Construction: Each tank molded, one-piece seamless. Minimum of 3 lifting lugs integrally molded into the top head.
4. Fittings: Minimum (3) three 2" threaded bulkhead fittings, located above liquid level, constructed of polypropylene with minimum ¼" thickness gaskets made of 40-50 durometer EPDM or 60-70 durometer Viton.
5. Tank Accessories:

a. Bolted Sealed Top Manway: 24 in., constructed of polyethylene with polypropylene bolts and closed cell, polyethylene foam and Viton materials.
b. U-Vent: PVC u-vent with screen, complying with OSHA 1910.106(F)(iii)(2)(IV)(9) normal venting for atmospheric tanks.
c. Internal Down Pipes: (2) 2" Schedule 80 PVC down pipes, supported as per manufacturer's recommendations.

6. Pipe Support Bridge/Pipe Hangers:
   a. Structure for Pipe Bridge: 1-5/8", 12 gauge strut channel supports with standard fittings and fasteners as manufactured by Unistrut or an approved equal.
   b. Pipe hangers: MSS SP-58, Type 1 or Type 12 for horizontal piping and Type 4, Type 12, or Type 24 for vertical piping, with factory fabricated components and galvanized metallic coating. Include continuous-thread rod, nuts, and washers where required.

7. Level Indicator System: Basis of Design: DST-2000 Series Ultrasonic Sensor with Model DCR-1006 Ultrasonic Controller as manufactured by Automation Products Group, Inc., or an approved equal.

   a. Sensor: Ultrasonic, programmable, designed for tank level applications.

      1) Application: Wet corrosive.
      2) Operating range: 1 to 25 ft.
      3) Accuracy: 0.25% of detected range.
      4) Transducer Type: PVDF-faced ceramic.
      5) Temperature Compensation: Required.
      6) Output: Direct to controller.
      7) Housing: Polycarbonate/PET blend
      8) Operating Temperature: -40 to 140 degrees F.
      9) Mounting: 2 in. NPT.
      10) Cable: Two conductor shielded standard RG-6 coaxial, length as required for attachment to controller located in vendor fill box.
      11) Ratings: NEMA 4X.
      12) Certifications: CSA C/US Class 1, Div. 2.

   b. Controller: For remote-mount ultrasonic level sensor. Shall be programmed to display volume (in gallons) of fluid remaining in storage tank.

      1) Input: DST sensor.
      2) Output: 4-20mA.
      3) Response Time: Programmable.
      4) Resolution: 0.1 in.
      5) Display: Four character LCD.
      6) Adjustment: Programmable keypad.
      7) Supply Voltage: 240VAC.
      8) Housing: Polycarbonate.
      9) Operating Temperature: -22 to 140 degrees F.

10) Size: 6.3 in. wide, 3.15 in. tall.
11) Ratings: NEMA 4X.

Pipes, Tubes, and Fittings:

Single Wall Pipe and Fittings: PVC pipe, UV resistant, Schedule 80, ASTM D1785 with threaded ends and fittings.

Cam and Lever Couplers: Basis of Design: Cam & Groove Series Fittings as manufactured by BANJO Corporation (www.banjocorp.com), or an approved equal. Cam and Lever Couplers shall be:

1. Interchangeable with all types of cam and lever couplers
2. Body Material: Polypropylene with glass filled fiberglass
3. Cam Levers: Stainless steel.
4. Pins: Stainless steel.
5. Gaskets: EPDM

Flex Hose: Reuse existing.

Valves:

Ball Valves Smaller Than 2": Basis of Design: WV Series Spin Weld Ball Valve as manufactured by BANJO Corporation (www.banjocorp.com), or an approved equal. Ball valves shall be:

1. Maximum operating pressure: 150 psig at 70 deg F.
2. Body Design: Two piece.
3. Body Material: Polypropylene.
4. Ends: Threaded.
5. Seats: PTFE or TFE.
6. Hardware: Stainless steel.
7. Port: Full.

Ball Valves 2" and Larger: Basis of Design: VS Series Stubby Valve as manufactured by BANJO Corporation (www.banjocorp.com), or an approved equal. Ball valves shall be:

1. Maximum operating pressure: 100 psig at 70 deg F.
2. Body Design: Two piece.
3. Body Material: Polypropylene.
4. Ends: Threaded.
5. Seals: PTFE or TFE.
6. Hardware: Stainless steel.
7. Port: Full.

~~Solenoid Valve: Basis of Design: Series PS as manufactured by Plast-O-Matic Valves, Inc. (www.plastomatic.com), or an approved equal. Solenoid valve shall be:~~

~~1. Maximum operating pressure: 140 psig.~~
~~2. Design: Normally closed, in-line with bubble-tight shut-off.~~
~~3. Solenoid: W11, continuous duty, NEMA 4X.~~
~~4. Body Design: Full port.~~
~~5. Body Material: Natural polypropylene.~~
~~6. Ends: Threaded.~~
~~7. Seals: FKM or EPDM.~~
~~8. 240-V AC, 60 Hz~~
~~9. 2- 0.75 Amp slow blow fuses in NEMA 4X enclosure~~

Antisiphon Valve: Basis of Design: Spring-Loaded Y Check Valve as manufactured by HAYWARD Flow Control Systems (www.haywardflowcontrol.com), or an approved equal. Antisiphon valve shall be:

1. Maximum operating pressure: 150 psig.
2. Body Material: PVC or Polypropylene.
3. Spring: 2-15 psig hand adjustable opening pressure, stainless steel, with lock ring.
4. Seals: FPM or EPDM double seal design.
5. Ends: Threaded

Check Valves: Basis of Design: MCV Series Poly Check Valve as manufactured by BANJO Corporation (www.banjocorp.com), or an approved equal. Check valves shall be:

1. Maximum operating pressure: 150 psig.
2. Body Design: One piece.
3. Body Material: Glass reinforced polypropylene.
4. Spring: 1-2 psig, stainless steel.
5. Ends: Threaded adapter.
6. Gasket: EPDM.
7. Port: Full.

Three-Way Valves: Basis of Design: V Series 3-Way Poly Ball Valve as manufactured by BANJO Corporation (www.banjocorp.com), or an approved equal. Three-way valves shall be:

1. Maximum operating pressure: 100 psig.
2. Body Material: Glass reinforced polypropylene.
3. Ends: Threaded.
4. Seals: PTFE or FKM.
5. Hardware: Stainless steel.

Dry Disconnect Valves: Basis of design: DM Series Dry Mate as manufactured by BANJO Corporation (www.banjocorp.com), or an approved equal. Dry disconnect valves shall be:

1. Maximum operating pressure: 100 psig.
2. Design: Male and female halves with interlocking handles that cannot be uncoupled in open position.

Identification for Piping and Equipment:

Equipment Labels, Warning Signs and Labels:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White
3. Background Color: Blue
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
9. Label Content: Include equipment's Plan designation or unique equipment number for equipment labels. Include caution and warning information, plus emergency notification instructions for warning signs and labels.

Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

1. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
2. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
3. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Plans, pipe size, and an arrow indicating flow direction.
4. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
5. Lettering Size: At least 1-1/2 inches high

Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.
3. Valve Schedules: For piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

    a. Valve-tag schedule shall be included in operation and maintenance manual and shall be framed and mounted on the wall in the Mechanical Room at a location determined by the Engineer.

Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

Sleeves and Sleeve Seals for Piping:

Sleeves: Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

Sleeve-Seal Systems: Basis of Design: MetraSeal Pipe Penetration Seal as manufactured by The Metraflex Company (www.metraflex.com), or an approved equal. Sleeve-Seal Systems shall be:

1. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

Miscellaneous Materials:

~~Pump Control Switch: Basis of Design: Momentary Contact 1262 as manufactured by Leviton, or an approved equal. Pump control switch shall be industrial grade momentary contact toggle switch rated for 30A with center off position. Switch shall be silver alloy with wire terminals capable of receiving and holding proper wire size as indicated on the plans.~~

Pump Control Push Button: Basis of Design: Momentary Contact Push Button XB5AP21 as manufactured by Schneider Electric, or an approved equal. Button shall be plastic booted, 22mm operator, with one normally open contact, NEMA 4X rated. Pump control push button shall include 1EJG8-Contactor as manufactured by Dayton, or an approved equal. Contactor shall be rated for 30 amps with a coil rating of 220 V. The contactor shall be equipped with DPDT contact, with silver allow contact material. Push button and contactor shall be mounted in a 4KN96-NEMA 4X Mounting Box (Stainless Steel) with associated 6XC20 -Interior Panel as manufactured by Wiegmann, or an approved equal.

~~Weatherproof Wall Plate: Basis of design HBL1795 as manufactured by Hubbell Wiring Device-Kellems, or an approved equal. Wall pate shall be gasketed and shall have self closing hinged cover. Wall plate shall be suitable for corrosive conditions, for use with all AC toggle switches.~~

Weatherproof Electrical Box: Basis of design: B112HB as manufactured by Carlon, or an approved equal. Electrical box shall be suitable for corrosive conditions, single gang for use with standard switches.

Calcium Chloride motor receptacle: 250 volt, single phase, 30 amperes, two pole, three wire, grounding type NEMA Configuration L6-30R. Rated for 3HP.

Conduit: As indicated on the Plans. Minimum raceway size shall be 3/4-inch trade size. All conduit installed for the system shall be PVC Schedule 80 conduit unless otherwise indicated. NEMA TC2, Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B. Liquidtight flexible metal conduit shall be provided from the calcium chloride motor to the junction box and from junction box to interior surface mounted switch and light fixture. LFMC: Liquid flexible steel conduit with PVC jacket.

Pull and Junction Boxes: Junction boxes shall be PVC inside the building. Exterior mounted enclosures shall be rated NEMA 4X. Boxes and fittings shall comply with the applicable provisions of NFPA 70, Article 314.

Hangers and Supports for Electrical Systems: Install conduit clamps within 3’ of boxes and at 10’ maximum distance between junction points. Hardware installed in corrosive areas shall be stainless steel. For areas inside use supports compatible with PVC Schedule 80 conduit. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4. Channel Dimensions: Selected for applicable load criteria. Raceway and Cable Supports: As

described in NECA 1 and NECA 101. Conduit and Cable Support Devices: Hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following: Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used. Concrete Inserts: Stainless Steel.

Conductors: The general requirements for conductors and their type designations, insulations and markings, mechanical strengths, ampacity ratings and uses shall conform to the standards set in the National Electrical Code (NEC) Article 310. Grounding conductor shall be annealed concentric stranded, copper cable sized in accordance to ASTM 8 and Article 250 of the NEC. Conductors shall be copper, insulated, 600 Volt, unless otherwise noted. Wire size No.8 and smaller shall be type THHN-THWN, unless otherwise noted or shown; wire size No. 6 AWG and larger shall be type THWN or XHHW. Conductors shall be installed in concealed metal raceway. Conductors shall be insulated and shall be color coded 240/120 Volt

Phase A Black
Phase B Red
Neutral White
Ground Green

Miscellaneous Materials:

Valve Boxes: Surface-mounted, heavy gauge stainless steel and a standard solid door and pull handle for access without a key, as manufactured by Larsen's Mfg. (www.larsensmfg.com), or an approved equal.

Signs – Sequence of Operation Signs. Cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thickness indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F and of the following general types:

1. Opaque Sheet: Provide plaque signs that are manufactured from 1/8" thick laminated engraving stock.
2. Engraved Copy: Engraved copy characters through the first background layer to expose the contrasting color of the inner core of the engraving stock.

    a. Panel Size: As required, with maximum size fitting on inside of valve box door.
    b. Engraving Stock Thickness: 1/8-inch minimum.
    c. Engraved Letter proportion: Letters and Numbers on signs shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10.
    d. Engraved Letter Size: Characters shall be 5/8 inch high.
    e. Background or first layer of engraving stock: Black

f. Inner core of engraving stock: White
g. Engraved letter style: Helvetica Medium with all upper case letters.
h. Mounting Methods: As indicated in the Installation section of Construction Methods.

Miscellaneous materials and fasteners as required to complete the work shown on the plans and described herein.

Filling of Calcium Chloride Tank: The Department will fill the Calcium Chloride Tank. The Contractor shall provide to the Engineer 7 calendar days notice of its need to have the tank filled for testing purposes.

1. Ownership of all product within the tank will remain with the Department.
2. Liability related to tank/piping system/pump failures or leaks of product shall remain with the Contractor until the system is accepted by the Engineer. In the event of a leak, the Contractor is responsible for all costs related to the environmental cleanup, system repairs, as well as reimbursement of the product costs to the Department.

Construction Methods:

Selective Demolition: The Contractor shall disassemble the existing calcium chloride storage and dispensing system as shown on the plans and described herein. Materials, such as the 5,000 gallon storage tank, noted to be salvaged shall be turned over to the state.

The state will empty the existing storage tank upon request to do so by the Engineer. The Contractor shall notify the Engineer a minimum of 7 calendar days in advance of the need to empty the tank.

Installation: The Contractor shall install the calcium chloride storage and dispensing system where shown on the plans, described herein, as required by manufacturer installation instructions, and as directed by the Engineer.

The Contractor shall (1) use equipment of adequate size to lift and set the tank and containment structure without dragging or dropping them; and (2) advise the Engineer of any shipping or handling damage to the containment structure encountered.

The contractor shall ~~relocate~~ remove existing calcium chloride pump control switch and indicator light. Electrical components shall be salvaged or as directed by the Engineer~~. The solenoid valve shall be provided with electrical connection to the existing pump such that pressing and holding the pump control switch will provide necessary power to energize the solenoid valve and then the calcium chloride pump motor, ensuring that the solenoid valve is energized before the pump can operate. The contractor shall install all junction boxes, conductors, and miscellaneous components necessary to control the circuitry of the solenoid valve.~~ The contractor shall install the calcium chloride pump control ~~switch~~ push button 48" AFG from the center of the ~~switch~~ push button at the location indicated on the plans.

Installation of Pipe Support Bridge/Pipe Hangers: Install pipe support as depicted on the Plans. Attach pipe support to Calcium Chloride storage tank per tank manufacturer's recommendations. Attach pipe support to maintenance facility exterior wall with mechanical-expansion anchors. Comply with MSS SP-69 for pipe hanger installation.

Installation of Identification for Piping and Equipment:

1. Preparation: Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
2. Equipment Label Installation: Install or permanently fasten labels on each major item of mechanical equipment and on each minor item of mechanical equipment as directed by the Engineer. Locate equipment labels where accessible and visible.
3. Pipe Label Installation: Color schedule shall be in accordance with ASME A13.1. Locate pipe labels as follows:

    a. Near each valve and control device.
    b. Near each branch connection, excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
    c. Near penetrations through walls and inaccessible enclosures.
    d. Near major equipment items and other points of origination and termination.
    e. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

4. Valve-Tag Installation: Install tags on valves and control devices in piping systems as directed by the Engineer, except check valves; valves within factory-fabricated equipment units; shutoff valves; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
5. Warning-Tag Installation: Write required message on, and attach warning tags to, equipment and other items where required.

Installation of Sleeves and Sleeve Seals: Install sleeves and sleeve seals for piping passing through walls. Select sleeves of size large enough to provide 1-inch annular clear space between piping and walls. Cut sleeves to length for mounting flush with both surfaces. Using grout, seal the space outside sleeves. Refer to CSI Division 03 Section 033000, "Cast in Place Concrete" for non-shrink grout. For sleeve seal, select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

Installation of Tank Level Indicator System: Sensor shall be located and installed in tank per sensor and tank manufacturer's written instructions. Provide access for maintenance of sensor. Controller shall be mounted below plow truck fill valve box as shown on Contract Plan C-005.

Installation of Sequence of Operation Signs: Signs located on valve boxes shall be permanently adhered to the valve box as indicated, unless otherwise directed by the Engineer. Signs located on facility walls shall be permanently anchored with stainless steel fasteners. Signs located on valve handles shell be permanently adhered using manufacturer's recommendations.

Calcium chloride dispensing system diagram with valve operation sign shall be located on the facility wall, near pump in an easily visible location. Sign shall be approximately 24"W x 20"H. Refer to Dispensing System Diagram with Valve Operation Sign image at the end of this Item for information to be included on this sign.

Tank recirculation sequence of operation sign shall be located on the facility exterior wall, adjacent to the Plow Truck Fill valve box and include the following information:

TANK RECIRCULATION

1. Verify that dry disconnect valve in Plow Truck Fill valve box and ball valve in Vendor Fill valve box are in the closed position.

2. Set Valve #3 located inside salt shed to tank recirculation position.

3. Open Plow Truck Fill Valve Box.

4. Press and hold pump control switch located next to the valve box to operate pump. Release pump control switch when finished.

5. Close Plow Truck Fill Valve Box. Reset Valve #3 to tank dispense position.

Each respective valve box shall have a sign mounted to, and centered on, the front of the door, and include the following information:

VENDOR FILL

1. Attach vendor fill hose to cam lock fitting in valve box.

2. Open ball valve located in valve box.

3. Fill Calcium Chloride Tank.

4. Close ball valve located in valve box.

5. Remove vendor fill hose, close valve box.

PLOW TRUCK FILL

1. Attach female end of dry disconnect valve on flex hose to male end located inside valve box with both ends in closed position.

2. Attach required cam lock fitting to truck headboard or hanging tailgate Calcium Chloride tank.

3. Open both male and female ends of dry disconnect valve located in valve box and on flex hose

4. Open ball valve located on flex hose.

5. Press and hold pump control switch located next to the valve box to operate pump. Release pump control switch when finished.

6. Close valves and detach hose in reverse order. Close valve box.

PLOW TRUCK OFFLOAD

1. Refer to instructions located near pump for required interior valve positions.

2. Attach female end of dry disconnect valve on flex hose to male end located inside valve box with both ends in closed position.

3. Attach required cam lock fitting to truck headboard or hanging tailgate Calcium Chloride tank.

4. Open both male and female ends of dry disconnect valve located in valve box and on flex hose.

5. Open ball valve located on flex hose.

6. Press and hold pump control switch located in valve box to operate pump. Release pump control switch when finished.

7. Close valves and detach hose in reverse order. Close valve box.

Emergency shutoff valves shall have a sign located adjacently, on the facility wall, indicating “EMERGENCY SHUTOFF VALVES”. Sign shall be approximately 12”W x 12”H.

Valves #1, #2, and #3 shall have signs adhered directly and permanently to each handle, indicating “VALVE #1”, “VALVE #2”, or “VALVE #3”, respectively. Valve signs shall be sized to fit on the valve handle. Valve #1 is the ball valve located near the pump inlet downstream of the calcium chloride tank. Valve #2 is the ball valve located near the pump inlet downstream of the plow truck offload valve box. Valve #3 is the three-way valve located downstream of the pump outlet.

Tests and Inspections:

Tanks: Minimum compressed-air test pressures for storage tanks: Isolate product piping from the tanks during testing. Minimum 3 psig and maximum 5 psig. Maintain the test pressure for one hour.

Piping: Minimum pneumatic test-pressures measured at highest point in system. Soap pipe fittings. Minimum 1.5 times the designed working pressure but not less than 5 psig for minimum 2 hours. Isolate storage tanks if test pressure in piping will cause pressure in storage tanks to exceed 10 psig.

Dispensing System: The Contractor shall provide to the Engineer 7 calendar days notice of its need to perform a system operational test. Methodically verify proper connection and integrity of each element of dispensing system before and during system operation test. Check for fluid leaks. Adjust antisiphon valve as per manufacturer’s written instructions. Fill one of each type (Headboard and Hanging) of truck mounted calcium chloride tank. Empty each type of truck mounted calcium chloride tank back into the 5000 gallon storage tank and verify pump regains prime. Replace damaged or malfunctioning equipment and make any repairs required, and retest as specified above.

Conductor Tests: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
3. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
    a. Verify grounding connections.

Method of Measurement:

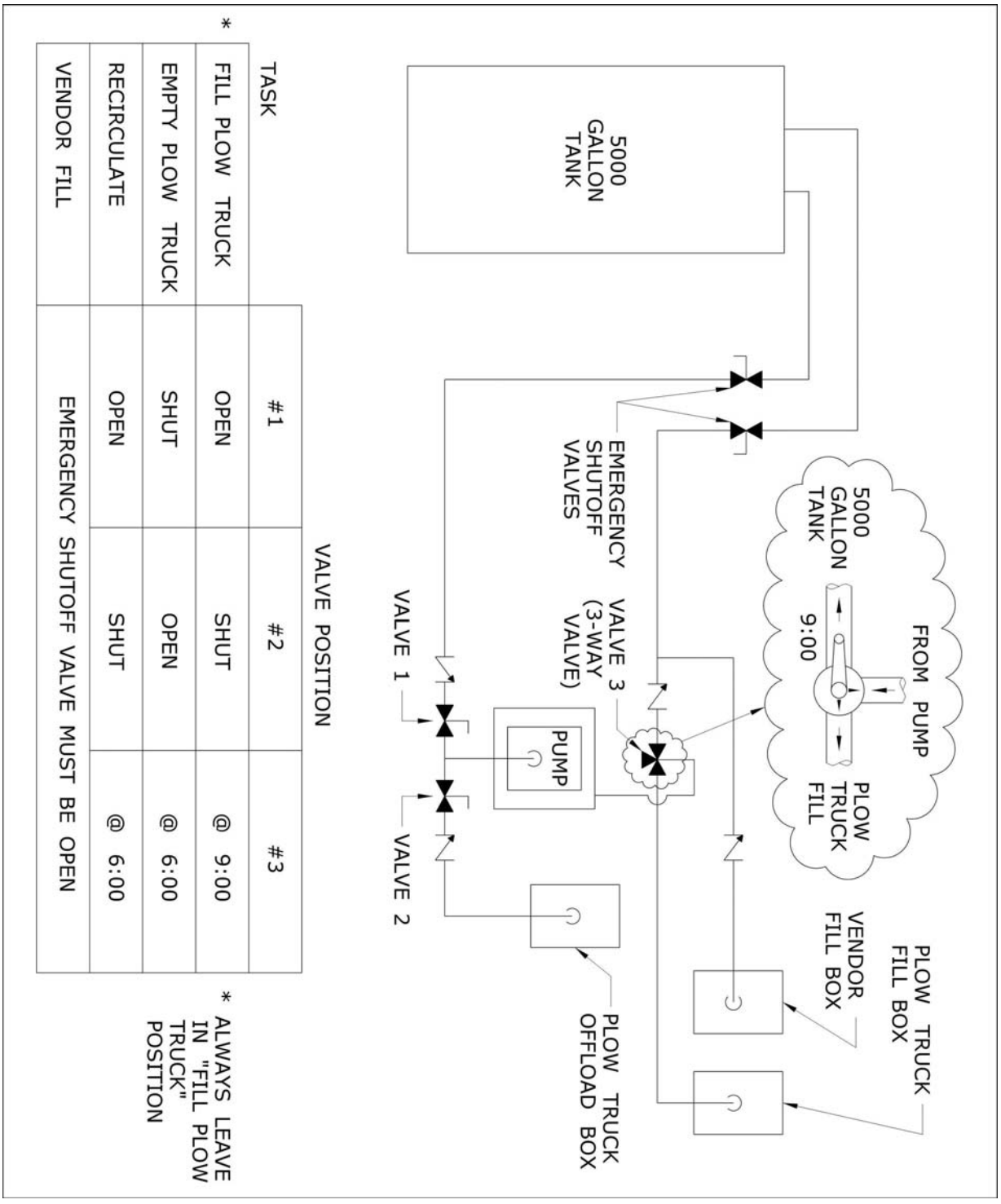
This item will be paid for at the contract lump sum price for "Roadway Deicing System" complete.

Basis of Payment:

This item will be paid for at the contract lump sum price for "Roadway Deicing System," which price shall include all administrative and procedural requirements, material, equipment, labor, and work incidental thereto.

PAY ITEM	PAY UNIT
Roadway Deicing System	LS

Dispensing System Diagram with Valve Operation Sign:



TASK	VALVE POSITION		
*	#1	#2	#3
FILL PLOW TRUCK	OPEN	SHUT	@ 9:00
EMPTY PLOW TRUCK	SHUT	OPEN	@ 6:00
RECIRCULATE	OPEN	SHUT	@ 6:00
VENDOR FILL	EMERGENCY SHUTOFF VALVE MUST BE OPEN		

* ALWAYS LEAVE IN "FILL PLOW TRUCK" POSITION

ITEM #0507171A - HYDRODYNAMIC SEPARATOR

Description: Hydrodynamic separators are proprietary devices manufactured for stormwater treatment. The hydrodynamic separator shall be a precast concrete structure and include an internal chamber with features that induce a swirling, circular, or spiraling flow pattern in the stormwater flow that separate and trap sediment and pollutants in a chamber that can be accessed for later removal.

This item will consist of furnishing and construction of a hydrodynamic separator, a flow diversion structure, manholes and pipes in the location, grades, treatment capacity and to the dimensions and details shown on the contract drawings, and in accordance with these specifications or as directed by the Engineer. The work also includes the preparation of hydraulic design calculations for the hydrodynamic separator(s) and flow diversion structure(s) as specified herein.

The hydrodynamic separator shall be assembled and installed in strict compliance with the Manufacturer's instructions unless otherwise directed by these specifications or by the Engineer. Internal flow controls / diversion components, external appurtenances, concrete manhole riser sections, manhole frames and covers, reinforcing, threaded inserts, lifting and seating fixtures, non-shrink grout, and all other necessary materials and equipment to complete the work shall be included.

This item shall also include the cleaning of the hydrodynamic separator of all sediment and debris every 90 days, or as needed, from when they are put into service, until final acceptance of the project.

Design Data:

Drainage area:	0.57 acres
Impervious area:	91%
WQF:	0.51 c.f.s.
DDF:	2.74 c.f.s. (for 10 year storm)
Time of Concentration:	0.37 min
Sediment Storage:	1.0 c.y. required

Approved Products and Manufacturer Information: Proprietary hydrodynamic separators currently approved by the Department are listed in Table 1 "**CONNDOT LIST OF APPROVED HYDRODYNAMIC SEPARATORS**". Company contact information is provided for convenience. *As the company information frequently changes, the Department is not responsible for its accuracy.*

The Engineer will reject any proposed hydrodynamic separator that is not listed in Table 1.

The listed products have been approved for use on Department projects based on only a general review of the product's construction, function and treatment capabilities. **Therefore, the approved list shall not be construed to mean that all products appearing on the list are suitable to any specific project site or drainage design.**

Performance: The stormwater treatment performance of the selected hydrodynamic separator shall be based on the water quality flow (WQF) as defined and calculated in accordance with the Department's current version of the Drainage Manual.

The hydrodynamic separator shall be designed to treat the entire WQF as indicated on the contract drawings or specifications, without bypass, either through the separator's internal components or at the flow diversion structure.

TABLE 1 – CONNDOT LIST OF APPROVED HYDRODYNAMIC SEPARATORS

HYDRODYNAMIC SEPARATOR PRODUCT NAME	COMPANY INFORMATION
Downstream Defender	Hydro International 94 Hutchins Drive Portland, Maine 04102 (207) 756-6200 http://www.hydrointernational.biz/us/index_us.php
FloGard Dual-Vortex Hydrodynamic Separator	KriStar Enterprises, Inc. 4020 Riverclub Drive Cumming, Georgia 30041 (770)-889-4338 http://www.kristar.com/
High Efficiency CDS	Contech Stormwater Solutions 200 Enterprise Drive Scarborough, Maine 04074 (800)-925-5240 http://www.contech-cpi.com/stormwater/13
Vortechs	
Vortsentry	
Hydroguard	Hydroworks, LLC 525Boulevard Kenilworth, NJ 07033 (888)-290-7900 / (908)-272-4411 http://www.hydroworks.org/
Stormceptor OSR	Rinker Materials – Stormceptor 69 Neck Road Westfield, MA 01085 (800)-909-7763 / (413) 246-7144 www.rinkerstormceptor.com
Stormceptor STC	
V2B1	Environment 21 8713 Read Road, P.O. Box 55 East Pembroke, New York 14056-0055 (800)-809-2801 / (585)-815-4700 www.env21.com

Hydrodynamic separator systems and models that have been pre-approved for use on Department projects and their corresponding maximum allowable WQF's for stormwater treatment are shown in **Table 2**, "**PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS**". The Engineer shall reject any proposed hydrodynamic separator system/model that is not listed in Table 2.

For more severe storm events that produce flows up to and including the drainage design flow (DDF) and which result in flows greater than the WQF being directed to the hydrodynamic separator from the flow diversion structure, the hydrodynamic separator shall be capable of conveying the portion of the DDF directed to it without surcharging the upstream storm drainage system and re-suspending previously trapped sediment.

The WQF to be treated and the portion of the DDF directed to the hydrodynamic separator when the drainage system is operating at its design flow are shown on the Hydrodynamic Separator Design Data Sheets (Form A - Design). A separate form for each hydrodynamic separator site on the project is attached to this specification.

Sediment Storage Capacity: Settleable solids shall accumulate in a location within the hydrodynamic separator structure that is accessible for cleaning and maintenance but not susceptible to resuspension. Direct access through openings in the precast concrete unit shall be provided to the sediment storage chamber and all other chambers to facilitate maintenance.

The standard sediment storage capacities for Department pre-approved hydrodynamic separator systems/models are shown in **Table 3**, "**STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS**". The sediment storage capacities listed in Table 3 are values based on standard structure dimensions and anticipated maintenance requirements.

Some standard hydrodynamic separator models may be modified as determined by the Manufacturer to increase the sediment storage capacity. When a modification is proposed by increasing the depth of the standard structure, the sediment storage capacity of the proposed structure shall be determined in accordance with **Table 4, "SEDIMENT STORAGE CAPACITY CALCULATION"**.

The Contractor shall be responsible for verifying the standard sediment storage capacity of the hydrodynamic separator unit(s) and coordinating any proposed modifications to increase sediment storage capacity with the Manufacturer(s). All proposed modifications and revised sediment storage capacity determinations shall be clearly documented in the working drawing submission to the Department.

The minimum sediment storage capacities required for each hydrodynamic separator site on the project are shown on the Hydrodynamic Separator Design Data Sheets (Form A – Design) attached to this specification.

Hydraulic Design: The Contractor shall prepare or have prepared a hydraulic grade line (HGL) analysis for an evaluation of the selected hydrodynamic separator and the design of the flow diversion structure as described in this section. The HGL analysis shall be performed for both the WQF and the DDF. The analysis shall be consistent with the methodology described in Section 11.12 of the Department's Drainage Manual.

Head loss coefficients, to be used in the HGL analysis, shall be determined in accordance with Section 11.12.6 for all structures except the hydrodynamic separator, which shall be obtained from the Manufacturer. Documentation shall be submitted demonstrating how the coefficient was derived either through calculation and/or testing data. A benching factor of 1.0 shall be applied to the flow diversion structure.

The HGL analysis (or portion of) that was performed for the design of the storm drainage systems and preparation of the construction plans, including the design of the flow diversion structure and evaluation of a "generic" hydrodynamic separator, is shown on the Hydrodynamic Separator Design Data Forms (Form A – Design) attached to this specification.

TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS

Maximum WQF (cfs)	**Product Model**								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
0.4	4-ft	DVS-36	2015-4G; 2015-4	HG 4	065	450	1000	VS30	2
0.5	4-ft	DVS-36	2015-4G; 2015-4	HG 4	065	900	1000	VS30	2
0.6	4-ft	DVS-36	2015-4G; 2015-4	HG 4	065	900	1000	VS40	2
0.7	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	900	1000	VS40	2
0.8	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	900	1000	VS40	2
0.9	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	1200	1000	VS40	3
1.0	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	1800	1000	VS40	3
1.1	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	1800	1000	VS40	4
1.2	6-ft	DVS-48	2015	HG 5	140	2400	1000	VS50	4
1.3	6-ft	DVS-60	2015	HG 5	140	2400	1000	VS50	4
1.4	6-ft	DVS-60	2015	HG 5	140	2400	2000	VS50	4
1.5	6-ft	DVS-60	2020	HG 5	140	2400	2000	VS50	6
1.6	6-ft	DVS-60	2020	HG 5	140	2400	2000	VS50	6
1.7	6-ft	DVS-60	2020	HG 5	250	2400	2000	VS50	6

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
1.8	6-ft	DVS-60	2020	HG 6	250	2400	2000	VS50	7
1.9	6-ft	DVS-60	2020	HG 6	250	3600	2000	VS60	7
2.0	6-ft	DVS-60	2020	HG 6	250	3600	2000	VS60	7
2.1	6-ft	DVS-60	2020	HG 6	250	3600	2000	VS60	9
2.2	6-ft	DVS-72	2025	HG 6	250	3600	2000	VS60	8
2.3	6-ft	DVS-72	3020, 3020-D	HG 6	250	3600	2000	VS60	8
2.4	6-ft	DVS-72	3035; 3035-D	HG 6	250	4800	2000	VS60	8
2.5	6-ft	DVS-72	3035; 3035-D	HG 6	250	4800	3000	VS60	10
2.6	6-ft	DVS-72	3035; 3035-D	HG 6	250	4800	3000	VS60	11
2.7	6-ft	DVS-72	3035; 3035-D	HG 7	250	4800	3000	VS60	11
2.8	6-ft	DVS-72	3035; 3035-D	HG 7	250	4800	3000	VS70	11
2.9	6-ft	DVS-72	3035; 3035-D	HG 7	250	4800	3000	VS70	12
3.0	6-ft	DVS-72	3035; 3035-D	HG 7	390	4800	3000	VS70	12

TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
3.1	8-ft	DVS-72	3035; 3035-D	HG 7	390	4800	3000	VS70	12
3.2	8-ft	DVS-72	3035; 3035-D	HG 7	390	4800	3000	VS70	12
3.3	8-ft	DVS-72	3035; 3035-D	HG 7	390	4800	3000	VS70	14
3.4	8-ft	DVS-72	3035; 3035-D	HG 7	390	6000	3000	VS70	14
3.5	8-ft	DVS-72	3030; 3030-DV, 3030-D; 4030-D	HG 7	390	6000	3000	VS70	14
3.6	8-ft	DVS-72	4030	HG 7	390	6000	3000	VS70	14
3.7	8-ft	DVS-84	4030	HG 8	390	6000	3000	VS70	14
3.8	8-ft	DVS-84	4030	HG 8	390	6000	4000	VS70	13
3.9	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS70	15
4.0	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	15
4.1	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	15
4.2	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	16
4.3	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	16
4.4	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	16
4.5	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	16
4.6	8-ft	DVS-84	5640-D	HG 8	390	7200	4000	VS80	17
4.7	8-ft	DVS-84	5640-D	HG 8	390	7200	4000	VS80	17
4.8	8-ft	DVS-84	5640-D	HG 8	390	7200	4000	VS80	17
4.9	8-ft	DVS-84	5640-D	HG 8	390	11000s	4000	VS80	17
5.0	8-ft	DVS-84	5640-D	HG 9	390	11000s	4000	VS80	19
5.2	8-ft	DVS-84	4040-D	HG 9	390	11000s	4000	VS80	20
5.4	8-ft	DVS-96	4040-D	HG 9	390	11000s	4000	VS100	20
5.5	8-ft	DVS-96	4045-D	HG 9	390	11000s	5000	VS100	18
5.6	8-ft	DVS-96	4045-D	HG 9	560	11000s	5000	VS100	18
6.0	8-ft	DVS-96	4040	HG 9	560	11000s	5000	VS100	18
6.1	8-ft	DVS-96	4040	HG 9	560	11000s	5000	VS100	21

TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
6.3	8-ft	DVS-96	4040	HG 9	560	11000s	5000	VS100	25
6.4	10-ft	DVS-96	4040	HG 9	560	11000s	5000	VS100	25
6.5	10-ft	DVS-96	4040	HG 10	560	11000s	5000	VS100	25
6.9	10-ft	DVS-96	4040	HG 10	560	11000s	5000	VS100	25
7.0	10-ft	DVS-96	4040	HG 10	560	11000s	5000	VS100	22
7.1	10-ft	DVS-96	5042-D	HG 10	560	11000s	5000	VS100	22
7.2	10-ft	DVS-96	5042-D	HG 10	560	13000s	5000	VS100	22
7.3	10-ft	DVS-96	4045	HG 10	560	13000s	5000	VS100	22
7.5	10-ft	DVS-96	5653-D	HG 10	560	13000s	7000	VS100	22
7.7	10-ft	DVS-120	5653-D	HG 10	560	13000s	7000	VS100	22
7.8	10-ft	DVS-120	5653-D	HG 10	560	13000s	7000	VS100	50
7.9	10-ft	DVS-120	5653-D	HG 10	780	13000s	7000	VS100	50
8.0	10-ft	DVS-120	5658-D	HG 10	780	13000s	7000	VS100	50
8.2	10-ft	DVS-120	5658-D	HG 10	780	16000s	7000	VS100	50
8.5	10-ft	DVS-120	5658-D	HG 12	780	16000s	7000	VS100	50
8.6	10-ft	DVS-120	5658-D	HG 12	780	16000s	7000	VS100	50
8.9	10-ft	DVS-120	5678-D	HG 12	780	16000s	7000	VS100	50
9.0	10-ft	DVS-120	5678-D	HG 12	780	16000s	7000	VS120	50
9.2	10-ft	DVS-120	5678-D	HG 12	780	16000s	7000	VS120	50
9.5	10-ft	DVS-120	5050-DV	HG 12	780	16000s	7000	VS120	50
9.6	10-ft	DVS-120	5050-DV	HG 12	780	16000s	7000	VS120	50
10.0	10-ft	DVS-120	5050-DV	HG 12	780	16000s	9000	VS120	50
10.1	10-ft	DVS-120	5050-DV	HG 12	780	16000s	9000	VS120	50
10.5	10-ft	DVS-120	5050-DV	HG 12	780		9000	VS120	50
10.9	10-ft	DVS-120	5050-DV	HG 12	780		9000	VS120	50
11.0	10-ft	DVS-120	7070-DV	HG 12	780		9000	VS120	50
11.2	10-ft	DVS-120	7070-DV	HG 12	1125		9000	VS120	50

TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
11.5		DVS-120	7070-DV	HG 12	1125		9000	VS120	50
11.8		DVS-120	7070-DV	HG 12	1125		9000	VS120	50
11.9		DVS-120	7070-DV	HG 12	1125		9000	VS120	60
12.0		DVS-120	7070-DV	HG 12	1125		9000	VS120	60
12.1		DVS-120	7070-DV	HG 12	1125		9000	VS120	60
12.5		DVS-120	7070-DV	HG 12	1125		11000	VS120	60
13.0		DVS-120	7070-DV		1125		11000	VS120	60
13.5		DVS-120	7070-DV		1125		11000	VS120	60
13.6		DVS-120	7070-DV		1125		11000	VS120	60
14.0		DVS-144	7070-DV		1125		11000	VS120	60
14.5		DVS-144	7070-DV		1125		11000		60
14.9		DVS-144	7070-DV		1125		11000		60
15.0		DVS-144	7070-DV		1125		16000		60
15.5		DVS-144	7070-DV		1125		16000		60
15.7		DVS-144	7070-DV		1125		16000		60
16.0		DVS-144	7070-DV				16000		60
16.5		DVS-144	7070-DV				16000		60
17.0		DVS-144	7070-DV				16000		
17.5		DVS-144	7070-DV				16000		
18.0		DVS-144	7070-DV				16000		
18.5		DVS-144	7070-DV				16000		
19.0		DVS-144	7070-DV				16000		
19.7		DVS-144	7070-DV				16000		
20.0		DVS-144	10060-DV				16000		
21.5		DVS-144	10060-DV				16000		
22.3		DVS-144	10060-DV				1319		
25.0			10060-DV				1319		
25.2			10060-DV				1319		

TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
27.6			10060-DV				1421		
29.3			10080-DV				1421		
30.0			10080-DV				1522		
31.2			10080-DV				1522		
33.6			100100-DV				1522		
35.0			100100-DV				1624		
38.2			100100-DV				1624		
40.0			100100-DV				1726		
43.2			100100-DV				1726		
49.3			100100-DV						

TABLE 3 - STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS

Sediment Storage (cubic yards)	**Product Model**								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
0.3		DVS-36					1000		
0.5	4-ft								
0.6							2000		
0.7		DVS-48		HG 4					
0.8					065	450		VS30	2; 3
0.9			2015-4G; 2015-4						
1.0 (minimum)							3000		
1.1					140	900			
1.2				HG 5					
1.3		DVS-60							
1.4							4000	VS40	
1.5			2015; 2020; 2025						
1.6									4
1.7				HG 6					
1.8	6-ft					1200			
1.9							5000		
2.0									
2.1									
2.2		DVS-72						VS50	
2.3				HG 7					
2.4									6; 7
2.5							7000		
2.6			3020, 3020-D; 3030, 3030-DV, 3030-D; 3035, 3035-D						
2.9					250	2400			

TABLE 3 - STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Sediment Storage (cubic yards)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
3.0				HG 8					
3.1							9000	VS60	
3.2									8; 9
3.3						1800			
3.4									
3.5		DVS-84							
3.6									
3.7	8-ft		5640-D						
3.8				HG 9					
3.9							11000		
4.0									
4.2									10; 11; 12
4.3			4030-D; 4040-D; 4045-D					VS70	
4.5									
4.6									
4.7									13
5.0				HG 10					
5.1									
5.3		DVS-96	5042-DV; 5050-DV						
5.5									
5.6			4030; 4040; 4045; 5653-D; 5658-D; 5678-D				16000	VS80	
5.7									
6.0						3600			
6.5									

TABLE 3 - STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Sediment Storage (cubic yards)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
6.6							1319		
6.9									
7.0									
7.1									
7.2									
7.3									14; 15; 16; 17; 18
7.5				HG 12					
7.6							1421		
7.7									
8.0									
8.3									
8.4			7070-DV						
8.6						4800			
8.7	10-ft				390		1522	VS100	
9.0									
9.5									
9.6									
9.9							1624		
10.0									
10.3		DVS-120							
10.5									19; 20
11.0									
11.2							1726		
11.3						6000			
11.5									21; 22
11.8									

TABLE 3 - STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Sediment Storage (cubic yards)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
12.0									
12.6								VS120	25
12.9					560				
13.0									
13.4						7200			
15.0									
17.5					780				
17.8		DVS-144	10060-DV;10080-DV; 100100-DV						
20.0									
22.3									50
25.0									
25.8					1125				
26.1						11000s			
26.2									
30.0									
34.1						13000s			
34.9									60
35.0									
38.7									
40.0									
40.7						16000s			

TABLE 4 - SEDIMENT STORAGE CAPACITY CALCULATION

Product	Sediment Storage Capacity (Volume) Calculation (cubic feet)
Downstream Defender	Inside Diameter (ft^2) of Structure x Distance (ft) from Bottom of Benching Skirt to Inside Floor of Structure
FloGard® Dual-Vortex	Inside Diameter (ft^2) of Structure x 1/2 Distance (ft) from Bottom of Vortex Tube to Inside Floor of Structure
High Efficiency CDS	Inside Diameter (ft^2) of Structure x Depth (ft) of Solids Storage Sump
Hydroguard	Inside Diameter (ft^2) of Structure x 1/2 Depth (ft) Below Outer Baffle Wall
Stormceptor STC	Inside Diameter (ft^2) of Structure x 1/2 Depth (ft) Below Drop Tee Inlet Pipe
Stormceptor OSR	Inside Diameter (ft^2) of Structure x 1/2 Depth (ft) Below Drop Tee Inlet Pipe
Vortechs	Inside Diameter (ft^2) of Grit Chamber x 1/2 Depth (ft) Below Opening in Swirl Wall
Vortsentry	Inside Diameter (ft^2) of Structure x Depth (ft) of Sediment Storage Sump
V2B1	Inside Diameter (ft^2) of Structure (D1) x 1/2 Depth (ft) Below Pipe Invert
Note: 1 cubic foot = 0.037 cubic yard or 1 cubic yard = 27 cubic feet	

Since the selected hydrodynamic separator and associated connecting pipes and structures may be different in type, configuration and performance than the one assumed in the design phase of the project, the hydraulic calculations performed for the drainage design must be replicated and revised to reflect any adjustments necessary to the drainage design for installation of the selected system, such as different flow-line elevations, head loss coefficient, pipe sizes, etc. The selected hydrodynamic separator shall be designed so as not to change the drainage system upstream of the flow diversion structure or to increase the HGL elevation upstream of the flow diversion structure. Any modifications necessary to the overall drainage design as a result of the Contractor selected hydrodynamic separator shall be the responsibility of the Contractor.

The new HGL analysis must demonstrate the following conditions:

1. The hydrodynamic separator can treat the WQF with no bypass. The HGL elevation at the flow diversion structure for the WQF shall be below the weir elevation and/or elevation of flow bypass that is listed in the design data form or shown in the plans, so that all of the WQF is directed to the hydrodynamic separator for treatment. The HGL elevation in the hydrodynamic separator at the WQF shall be below the elevation of internal bypass so that all of the WQF is treated by the system.

2. When the drainage system is operating at the DDF, the hydraulic computations must show that the HGL elevation at the flow diversion structure is lower than or equal to the HGL elevation shown on Form A for the DDF and the HGL elevation in the hydrodynamic separator must be a minimum of one foot below the top (ground) elevation of the structure. A HGL elevation in the flow diversion structure for the DDF which is higher than the corresponding HGL elevation shown on Form A may be approved by the Engineer only if hydraulic computations are submitted showing that the higher HGL elevation will provide a minimum of one foot of freeboard below the top (ground) elevation of the flow diversion structure and the upstream drainage structures, satisfying the design criteria stated in the Connecticut Department of Transportation Drainage Manual. To demonstrate compliance, the hydraulic analysis shall be extended to a point upstream in the drainage system that is not influenced by the proposed changes and where the results converge with the previous design analysis. In such a case, the Contractor shall request a copy of the design analysis from the Department. A freeboard less than one foot may be accepted by the Engineer on a case by case basis provided that a justification of the reason has been included with the HGL analysis.

3. When the drainage system is operating at the DDF, the resulting HGL elevation and flow split at the flow diversion structure has been designed such that the portion of the DDF directed to the hydrodynamic separator does not exceed the maximum flow shown on the Hydrodynamic Separator Design Data Sheets (Form A - Design). Documentation, however, must be provided that the flow in excess of the WQF can pass through the device without washout of the previously captured sediment or the device is equipped with an internal bypass to route the excess flow around the treatment chamber.

Upon conclusion of the HGL analysis, the Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal) shall be completed by entering the HGL analysis data and other required information.

Hydrodynamic Separator Selection: To ensure compliance with the special provision, the selection process of a proprietary hydrodynamic separator for installation on a Department project is outlined by the following steps:

1. First, select the available product(s) from Table 2 (**PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS**) that meet or exceed the WQF treatment specified on the Hydrodynamic Separator Design Data Sheets (Form A - Design) attached to this specification. **The Engineer shall reject any proposed hydrodynamic separator system/model that is not listed in Table 2.**

2. Using Table 3 (**STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS**), check whether the initially selected product(s) in Step 1, meet or exceed the minimum sediment storage requirement specified on the Hydrodynamic Separator Design Data Sheets (Form A - Design). In some cases, the required sediment storage capacity will govern the model size required for the project. In lieu of selecting a larger model to accommodate the sediment storage requirement, the Contractor may submit working drawings as recommended by the Manufacturer, showing how a standard model has been modified to satisfy the sediment storage requirement. When a modification is proposed by increasing the depth of the standard structure, **Table 4 (SEDIMENT STORAGE CAPACITY CALCULATION)** shall be utilized to determine the sediment storage capacity of the proposed structure.

3. **Hydrodynamic separator system/models pre-approval by the Department shall not be construed to mean that all products appearing on Tables 2 and 3 are suitable to any specific project site or drainage design.** The Contractor shall verify the constructability of the selected hydrodynamic separator in relation to dimensional, structural, geotechnical and right-of-way constraints at each installation site. If revisions to the drainage design, including the system layout, are required to accommodate the selected separator, the Contractor shall provide working drawings showing the revised layout, including the position of the hydrodynamic separator and the number, positions and types of connecting structures, the design of the flow diversion structure, and any other components of the system within the pay limits. The working drawings shall be prepared in sufficient detail to perform a hydraulic analysis and confirm that the layout will fit the constraints of each site.

4. Upon determination that the WQF, sediment storage and constructability requirements have been met, the Contractor shall prepare or have prepared, a HGL analysis in accordance with the hydraulic requirements of this special provision, that includes the selected hydrodynamic separator and any revisions to the drainage design needed for the installation.

5. The Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal) shall be completed and signed by a professional engineer licensed by the State of Connecticut.

6. *Acceptance of the computations by the Engineer must be obtained by the Contractor prior to the purchase or installation of any units.*

Materials: Materials utilized to fabricate, construct and install the precast concrete hydrodynamic separator including but not limited to precast concrete units, brick, concrete masonry units, manhole frames and covers shall meet the requirements specified in the Standard Specifications, Form 816, Article M.08.02, except that the 28 day compressive strength specified in Subarticle M.08.02-4, shall be a minimum of 4000 psi (27.6 MPa).

The Contractor shall provide a Materials Certificate in accordance with 1.06.07 for each unit delivered to the project. Upon request, the Contractor shall also provide Certified Test Reports for the fine and coarse aggregates and all cementitious materials, and the concrete mix design indicating the weight of each component, used in the construction of the precast units for review. The structures shall not be shipped until released by the Contractor's Quality Control Manager or designee.

The wall and slabs of the precast concrete units shall be designed to sustain HS20-44 (MS18) loading requirements.

Manholes and Catch Basins shall conform to Section 5.07 of Form 816.

Granular fill shall conform to the requirements of Article M.02.01 of Form 816.

Non-shrink grout shall conform to the requirements of Subarticle M.03.01-12 of Form 816.

Drainage pipe, sealant and gaskets shall conform to the requirements of Article M.08.01 of Form 816.

Mortar shall conform to the requirements of Article M.11.04 of Form 816.

Sealant used for the hydrodynamic separator unit(s) shall be resistant to oil and other hydrocarbons and conform to the requirements of ASTM C-443.

Working Drawings: Working drawings in accordance with Article 1.05.02 – 2 shall be required for the system selected by the Contractor. The working drawings shall include the HGL analysis and all other computations in strict accordance with the "Hydraulic Design" section of this special provision, including a completed Form B – Contractor Proposal.

If revisions to the layout of the system within the payment limits of this item are required to accommodate the selected separator, the working drawings shall also include plans that show the required revisions. These plans shall show the revised position of the hydrodynamic separator unit(s), and all revisions to connecting structures, pipes, elevations, and details, including the

design within the flow diversion structure. The revised plans shall also include the pay limit showing all the components of the system that are included in this lump sum pay item.
Working drawings shall also show details for construction, reinforcing joints, internal and external components, any cast-in-place appurtenances, locations and elevations of pipe openings, access manhole locations and elevations, and type / method of sealing pipe entrances.

Working drawings for each hydrodynamic separator on the project shall have all appropriate vertical dimensions referenced with elevations that are consistent with the project plans. In addition to any other structural, material or installation requirements, the working drawings shall clearly indicate the following information:

1. The elevation and flow rate when internal flow bypass would occur within the device.

2. The location, dimensions and volume (capacity) of the sediment storage area within the device.

The working drawings shall be sealed by a professional engineer licensed in the state where the devices are manufactured and that said engineer shall certify the device meets the minimum requirements of the ConnDOT Standards.

The working drawing submission by the Contractor shall consist of the following documents:

1. Working drawings for each hydrodynamic separator proposed for installation on the project.

2. Hydraulic design calculations including the head loss documentation and completed Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal) with professional engineer signature for each hydrodynamic separator.

3. Copies of the pertinent construction plan, profile, cross section and detail sheets that have been annotated with any proposed drainage revisions that are required for the installation of the proposed hydrodynamic separator(s). If no changes are required, the submittal shall note same.

4. An Operations and Maintenance Manual for each hydrodynamic separator describing operations, inspection, maintenance procedures and any applicable warranty information.

Acceptance of the working drawing submission by the Engineer must be obtained by the Contractor prior to the fabrication of each hydrodynamic separator and diversion structure.

Construction Methods: The Contractor shall inspect the hydrodynamic separator and any accessory equipment upon delivery for general appearance, dimensions, soundness or damage in a manner acceptable to the Engineer. If any defects or damage are identified by the inspection, the unit shall be rejected by the Contractor and a new undamaged hydrodynamic separator shall be supplied. Any required adjustments of the separator shall be completed in accordance with

Manufacturer's recommendations. A Manufacturer's representative and the Engineer will inspect the hydrodynamic separator before installation.

The Contractor shall install the hydrodynamic separator structure in accordance with the Manufacturer's recommendations unless otherwise directed by this specification or by the Engineer. The hydrodynamic separator shall be installed plumb, level and aligned both vertically and horizontally with the inlet and outlet piping. The hydrodynamic separator shall be placed on a compacted granular fill base in accordance with the Manufacturer's specifications or a minimum thickness of 6" (150mm) whichever is larger. Anchoring systems shall be installed, where needed, to resist buoyancy forces. Care shall be taken not to damage the hydrodynamic separator during backfill and compaction.

Pipe openings in the hydrodynamic separator shall be sized to accept pipes of the specified size(s) and material(s) as shown on the contract drawings and shall be sealed by the Contractor in accordance with the requirements of this specification. The inlet and outlet pipe connections shall be watertight. The hydrodynamic separator shall be tested for leakage according to the Manufacturer's specifications and to the satisfaction of the Engineer. Any leaks must be found and corrected to the satisfaction of the Engineer prior to acceptance of the structure.

Access openings with manhole frames and covers shall be provided to all chambers of the hydrodynamic separator. The access openings and pipe openings shall be detailed on the working drawings to be submitted by the Contractor for review and acceptance by the Engineer.

All connecting structures and pipes included within the payment limits for this work shall be constructed in accordance with the applicable requirements of Article 5.07.03 and Article 6.51.03.

Method of Measurement: Design, construction, furnishing, installation and cleaning of the hydrodynamic separator, the flow diversion structure, manholes and pipes as shown on the contract drawings, including all internal and external appurtenances and materials used, will be paid for on a lump sum basis per site.

Basis of Payment: This work will be paid for at the contract lump sum for "HYDRODYNAMIC SEPARATOR", complete in place, which price shall include all work within the pay limits shown on the contract drawings for hydrodynamic separator. If revisions to the layout of the system within the payment limits for this item are required to accommodate the selected separator, the lump sum price shall also include all additional or revised connecting structures and pipes. The contract lump sum shall include, but not be limited to, the following:

1. Design, preparation, revisions of working drawings and hydraulic computations.

2. Concrete and reinforcing steel, sealant, cement, mortar, flexible rubber sleeves, internal and external components, brick and masonry, frames and covers used to construct access manholes.

3. Flow diversion structure, manholes and pipes as shown on the contract drawings, or as revised and shown on submitted working drawings accepted by the Engineer.

4. Structure excavation, back fill, and disposal of surplus material.

5. Compacted granular fill.

6. Trench excavation and bedding material.

7. Cleaning of the Hydrodynamic Separator, flow diversion structure, manholes and pipes as shown on the contract drawings (of all debris every 90 days, or as needed), during the duration of the project, shall also be included in the price of this item.

8. The Operations and Maintenance Manual for each hydrodynamic separator.

The price shall include but not be limited to all materials, testing, equipment, tools and labor incidental thereto.

Attachments: The following documents are attached to this specification:

1. Hydrodynamic Separator Design Data Sheets (Form A – Design), Sheets 1 & 2 of 2.

2. Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal), Sheets 1 & 2 of 2 (blank), to be completed and submitted with the working drawings.

SAMPLE DATA

CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS (FORM A - DESIGN)

Project No	*Example*	Route No.	*0*	Prepared By:	*HD*	Date:	*4/1/2010*
Town	*Somewhere*	Location/Station	*Site 1*	Checked By:	*DM*	Date:	*4/1/2010*
				Company:	*ConnDOT*		

HYDROLOGIC DATA

Drainage Area (Acres)	*3.7*
Percent Impervious Area %	*53*
Time of Concentration (min.)	*11*
Drainage Design Flow (cfs)	*10.8*
Drainage Design Frequency (yr)	*10*
Water Quality Flow (cfs)	*1.7*

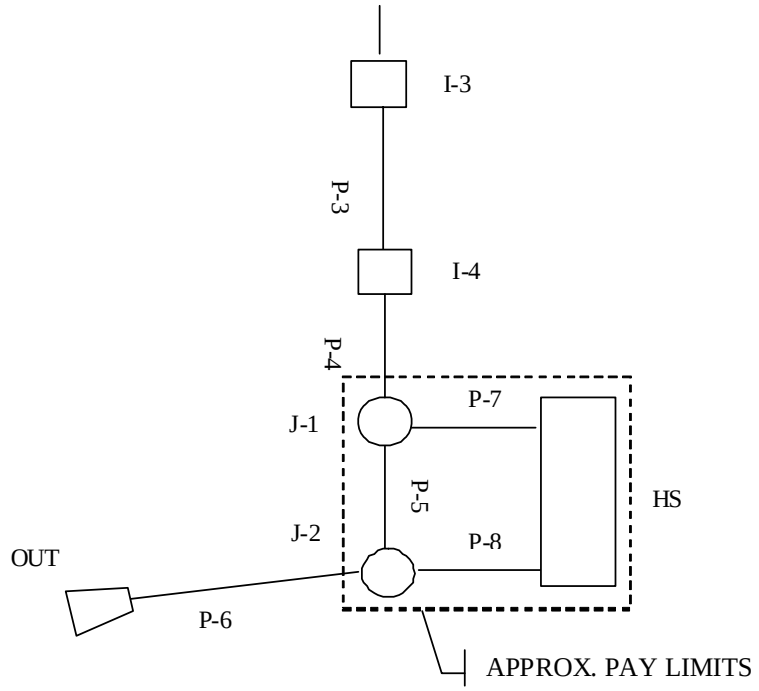
HYDRODYNAMIC SEPARATOR (HS)

Coordinates:		Datum:	
X:	*XXX,XXX*	Horiz.	*State Plane NAD83*
Y:	*YYY,YYY*	Vert.	*NGVD-1929*
Head loss coefficient		*1.75*	
Sediment Storage Capacity (cy):		HGL Elevation:	
Required	*1.0*	@ WQF	*104.13*
		@ Design Q	*104.85*
Maximum Flow to HS at Drainage Design Flow (cfs)			*4.3*

Comments:

FLOW DIVERSION STRUCTURE

Type	*4' Diameter Manhole*		
Weir and/or Bypass Elev.	*104.50*		
Weir Length (ft.)	*4*	Weir Coeff. (C)	*3.3*
HGL Elevation:		Flow Split @ Drainage Design Flow	
@ WQF	*104.20*	To HS	*3.2*
@ Design Q	*105.20*	Bypassing HS	*7.6*



Sketch (NTS) - Indicate Pay limits

Comments:

Sheet 1 of 2

SAMPLE DATA

CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS
(FORM A - DESIGN)

Project No:	*Example*	**Location/Station:**	*Site 1*	**Date:**	*4/1/2010*

HYDRAULIC GRADE LINE ANALYSIS

Pipe	Downstream Str.	Pipe Size (in)	Flow (cfs)	Ground Elev. OUT (ft)	Invert Elev. OUT (ft)	HGL OUT (ft)	Depth OUT (ft)	Vel. Head OUT (ft)	EGL OUT (ft)	Length (ft)	Friction Slope (ft/ft)	Friction Loss (ft)	EGL IN (ft)	Vel. Head IN (ft)	HGL IN (ft)	Depth IN (ft)	Invert Elev. IN (ft)	Ground Elev. IN (ft)	Upstream Str.	Headloss Coeff.	Str. headloss (ft.)
			WQF																		
P-6	OUT	24	1.70	106.48	103.04	103.47	0.43	0.19	103.65	25	0.0047	0.12	103.77	0.16	103.61	0.45	103.16	108.86	J-2	0.01	0.00
P-8	J-2	12	1.70	108.86	103.16	103.71	0.55	0.23	103.94	6	0.0058	0.03	103.97	0.21	103.76	0.57	103.19	108.86	HS	1.75	0.37
P-7	HS	12	1.70	108.86	103.19	104.13	0.94	0.08	104.21	6	0.0017	0.01	104.22	0.08	104.14	0.91	103.23	109.19	J-1	0.82	0.06
P-4	J-1	24	1.70	109.19	103.23	104.20	0.97	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10	YR	DESIGN	FLOW																	
P-6	OUT	24	10.80	106.48	103.04	104.20	1.16	0.51	104.71	25	0.0048	0.12	104.83	0.49	104.34	1.18	103.16	108.86	J-2	0.05	0.02
P-8	J-2	12	3.20	108.86	103.16	104.36	1.20	0.26	104.62	6	0.0069	0.04	104.66	0.26	104.40	1.21	103.19	108.86	HS	1.75	0.45
P-7	HS	12	3.20	108.86	103.19	104.85	1.66	0.26	105.11	6	0.0069	0.04	105.15	0.26	104.89	1.66	103.23	109.19	J-1	1.18	0.31
P-4	J-1	24	10.80	109.19	103.23	105.20	1.97	0.18	105.38	88	0.0018	0.16	105.54	0.24	105.30	1.63	103.67	112.96	I-4	0.11	0.03
P-3	I-4	24	9.10	112.96	103.87	105.33	1.46	0.22	105.55	185	0.0041	0.76	106.31	0.43	105.88	1.08	104.80	109.55	I-3	----	----
P-6	OUT	24	10.80	106.48	103.04	104.2	1.16	0.51	104.71	25	0.0048	0.12	104.83	0.49	104.34	1.18	103.16	108.86	J-2	0.05	0.02
P-5	J-2	24	7.60	108.86	103.16	104.36	1.20	----	----	----	----	----	----	----	104.36	1.13	103.23	109.19	J-1	----	----

Sheet 2 of 2

CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS (FORM B - CONTRACTOR PROPOSAL)

Project No		Route No.	
Town		Location/Station	

PE Signature:	
Name:	Date:
License No:	State:
Company:	

HYDROLOGIC DATA (Copy from FORM A - DESIGN)	
Drainage Area (Acres)	
% Impervious Area	
Time of Concentration (min.)	
Drainage Design Flow (cfs)	
Drainage Design Frequency (yr)	
Water Quality Flow (cfs)	

HYDRODYNAMIC SEPARATOR (HS)			
Manufacturer			
Model Name			
Model No.			
Coordinates:		Datum:	
X:		Horiz.	
Y:		Vert.	
Sediment Storage Capacity (cy):		HGL Elevation:	
Required		@ WQF	
Installed		@ Design Q	
Head loss coefficient			

FLOW DIVERSION STRUCTURE			
Type			
Weir and/or Bypass Elev.			
Weir Length (ft.)		Weir Coeff. (C)	
HGL Elevation:		Flow Split @ Drainage Design Flow (cfs):	
@ WQF		To HS	
@ Design Q		Bypassing HS	

Sketch (NTS)

Comments:

Sheet 1 of 2

CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS (FORM B - CONTRACTOR PROPOSAL)

Project No:		Location/Station:		Date:	

HYDRAULIC GRADE LINE ANALYSIS

Pipe	Downstream Str.	Pipe Size (in)	Flow (cfs)	Ground Elev. OUT (ft)	Invert Elev. OUT (ft)	HGL OUT (ft)	Depth OUT (ft)	Vel. Head OUT (ft)	EGL OUT (ft)	Length (ft)	Friction Slope (ft/ft)	Friction Loss (ft)	EGL IN (ft)	Vel. Head IN (ft)	HGL IN (ft)	Depth IN (ft)	Invert Elev. IN (ft)	Ground Elev. IN (ft)	Upstream Str.	Headloss Coeff.	Str. headloss (ft.)

ITEM #0969049A - DOCUMENT CONTROL SPECIALIST (MINIMUM BID)

Description: Under this item the Contractor shall furnish the services of one of his administrative employees, entitled Document Control Specialist, who will ensure that the Contractor, and all other parties designated by the Engineer, will prepare, status, electronically file and send all project correspondence and drawings utilizing a document control system as established and maintained by the Department. The primary function of the document control system is to ensure timely processing of all contract documentation in coordination with the project schedule. This document control system will also provide uniform project information and reporting. The Document Control Specialist shall be designated by name, in writing, with a resume of their qualifications, within five (5) calendar days of the award of the Contract and shall not be changed without prior written notice to the Department.

The Document Control Specialist shall be knowledgeable of the status of all contract documentation aspects of the work throughout the length of the Contract. The Contractor shall prepare and maintain the contract documentation utilizing the latest version of PMWEB. The document control system will be physically located in a secure location designated by the Department. The Contractor will directly access the document control system via the internet. The Department will provide the Contractor access to the latest version of PMWEB and a common file server. All references to the use of PMWEB and the common file server below shall refer to the Department's shared document control system as described above. All information that resides on the shared document control system shall become the sole property of the Department.

The minimum lump sum bid for this item shall be **$25,000** (twenty-five-thousand dollars). Failure of the Contractor to bid at least the minimum amount will result in the Department adjusting the Contractor's bid to include the minimum bid amount for this item.

Documentation Requirements: All correspondence for the project shall be produced and controlled using PMWEB, including, but not limited to, transmittals, meeting minutes, requests for information (RFI's), requests for change (RFC's), submittals, field memos, notices, letters, and punch lists. All common correspondence files (submittals, requests, answers, changes, reports, minutes, agendas, letters, etc) shall be generated from, and stored within the common file server, including any and all file attachments. Submittals, including shop drawings, working drawings, catalog cuts, material certifications, certified payrolls, and all documentation required by contract, shall be submitted electronically via PMWEB. The Contractor is responsible to coordinate the overall creation and submission of all project documentation to meet the requirements of the project schedule and specifications. The Contractor is encouraged to supply the Department with corporate logos, formats, etc., to facilitate the creation and utilization of custom forms and reports.

The named Document Control Specialist shall be designated as the Submittal Coordinator within PMWEB and will be responsible for maintaining information related to the responsibility, status, elapsed time since submission, held time, start/finish times, and a history of all submittal revisions. A submittal log must be maintained to indicate the latest construction submittals sent and received, and the distribution of these drawings to the Department. Each submittal (shop drawing, working drawing, product data, samples, etc) must be individually entered, tracked, and the status maintained, including all revisions. The Contractor is responsible to utilize the latest approved drawings as identified in the control system. All revisions are to be logged into the control system, describing each change.

All meeting minutes shall be logged into the control system. The Contractor is responsible to utilize meeting minutes and respond (electronically) to meeting minute items assigned to the Contractor.

Documents (letters, logs, shop or working drawings, sketches, payrolls, etc) to be transmitted to the Department by the Contractor, for which the Contractor does not have an electronic version, shall be scanned, converted into an Adobe Acrobat PDF format, and attached accordingly in PMWEB.

The document control system shall be available for Contractor use at all times unless system maintenance (i.e. backups, upgrades, etc) is being performed. System maintenance will generally be limited to 10 PM – 6AM, Monday - Friday and at various times on weekends. In the event a Contractor's authorized user cannot access the control system, the Contractor shall notify the Department's control system representative. In the event the control system becomes unavailable during normal business hours for an extended period of time, the Contractor may issue correspondence requiring immediate attention by the Department in hard copy format. The hard copy correspondence must be entered into the control system immediately upon becoming available again. Inability by the Contractor to gain access to the document control system for any reason shall not be grounds for claim. The use of the database is not required for proprietary cost and contract information.

The Department shall be allocated a minimum of seven (7) calendar days (using a 7-day calendar, exclusive of holidays) for review and response to each RFI submitted. RFI's requiring information from outside agencies shall be allocated twenty-one (21) days (using a 7-day calendar, exclusive of holidays).

The Department shall be allocated a minimum of thirty (30) calendar days (using a 7-day calendar, exclusive of holidays) for review and response to each RFC submitted. RFC's requiring information from outside agencies shall be allocated sixty (60) days (using a 7-day calendar, exclusive of holidays).

The Department reserves the right to reject any RFC submitted in the form of an RFI for the purpose of reducing the Department's review and response time. Such documents will not be considered for review by the Department and will be returned to the Contractor for resubmission.

Review and response time for such document will commence upon resubmission in the correct format.

The Department shall be allocated a minimum of thirty (30) calendar days (using a 7-day calendar, exclusive of holidays) for review and approval of each submittal, unless specified otherwise within the contract documents. Any submittals requiring approval by an outside Agency (ConnDEP, local municipality, utility, etc.) shall be allocated a minimum of sixty (60) calendar days (using a 7-day calendar, exclusive of holidays). Whenever multiple Contractor submittals are under review by the Department, the Contractor shall prioritize the submittals and notify the Department thereof. The Department shall not be held responsible for any delay associated with the approval or rejection of any substitution or other revisions proposed by the Contractor.

Submittal activities must be coordinated such that submittal information common to both the project schedule and the document control system (required and actual dates, sequence of submission, resubmissions if required) correspond with one another. All resubmissions shall be numbered with the original submittal number but shall be designated a new revision number. All resubmissions shall be logged into the control system to properly calculate the entire duration required for the submittal process, from the original submission date to final approval, to indicate total days to process the submittal through all review cycles. Coordination of submittals is required for same work and interfacing work so that one submittal will not delay another.

The submittal log will be developed according to the following format:

Submittal Package

The Package name shall be the seven digit Item Number. The Package Title shall be the corresponding Item Name. Instances where contract items require an extensive number of submittals (i.e. rebar, structural steel, etc), packages shall be further separated by structure components or location. For example:

Package	Title
0602006-01	Deformed Steel Bars – Epoxy Coated / B3039
0602006-02	Deformed Steel Bars – Epoxy Coated / B167
0602006-03	Deformed Steel Bars – Epoxy Coated / B6609

Instances where a submittal requires review by more then one department or agency (i.e. traffic items requiring both CDOT and City of New Haven review), the multiple reviewers option must be checked so that the individual reviewers can be designated, with each reviewer receiving a copy of the submittal for review.

The Package status shall initially be “Unsubmitted”. Upon submission of any submittal within the package the status shall of the package be changed to “Open”. Upon receipt of all final review comments for all package submittals, the status shall be changed to “Closed”.

Submittal Item

All submittal items, as required by contract, must be individually entered, including shop & working drawings, product data, samples, etc. All submittals shall be associated with, and generated within, a specific package. The submittal number shall be the package name followed by a three digit incremental number (i.e. 1205201-01-001, 0602006-03-001). The title shall be a clear description of the submittal item. In the case of a drawing submittal, the title shall be the exact name of the drawing and the drawing number shall be entered in the Details section of the review cycle. The appropriate Category and Type shall then be selected.

Shop drawings shall be submitted in Adobe Acrobat PDF Package format. Each drawing will be included as a separate file within the package and named in kind with the drawing number. The PDF package shall be listed and attached in PMWEB to the first submittal. The drawings shall be listed individually thereafter.

Working drawings shall be submitted in Adobe Acrobat PDF format. The PDF package shall be listed and attached in PMWEB to a single submittal.

Electronic submittal attachments shall be named in kind with the submittal to which they are attached and include the revision number (i.e. Submittal 0602006-03-001 would have a PDF attachment named 0602006-03-001-1.pdf).

Submittals requiring signature by a licensed engineer or other party shall be digitally signed utilizing a digital ID obtained from an Adobe partner (see adobe.com for list of partners).

Required Start & Required Finish shall represent the date range for the review process. Required Start shall be the date the submittal is issued by the Contractor for review. Required Finish shall be the completion date for the review cycle (either 30 or 60 days later as appropriate). These dates will be reset by the Contractor for each additional review cycle.

Workflow must be completed for each submittal. Received From shall be the party from which the submittal originated (prime contractor, subcontractor, fabricator, vendor, etc). Sent To and Returned By shall be the primary reviewer as designated by the contract documents. Forwarded To shall be the Contractor's designated submittal coordinator.

Review cycles will be numbered 001, 002, 003, etc., according to the number of resubmissions. Distributions (submittal recipients) must be listed on the transmittal.

Submittal Forecast

In order facilitate the Department's review of the large number of submittals anticipated for this project; the Contractor is to provide a submittal schedule. The submittal schedule will be created and maintained in PMWEB as follows:

A submittal package must be created for each contract item requiring a submittal (note that large submittal items must be broken out as prescribed above). Within each package, a single

submittal, numbered 001, will be generated from the submittal package which will be utilized to approximate when submittals for that package will be submitted for review. At a minimum, the submittal Number, Title, Status, Required Start, and Required Finish must be entered, where the Status is "Unsubmitted" and the Required Start and Required Finish represents the review period for all submittals within this package. The Required Start and Required Finish dates must be coordinated with the project CPM schedule.

Documentation Control System Access Requirements: Within five (5) days of Contract Award, the Contractor shall designate, in writing, up to five (5) named Contractor personnel, to be approved and authorized by the Engineer to access the document control system. The Contractor shall designate one of the five authorized personnel to be the Document Control Specialist and act as the document control system contact person for the Contractor. That person shall be experienced and trained in the use of PMWEB. All Contractor personnel requesting access authorization must complete the minimum training requirements described below and submit a certificate of completion to the Department. Upon receipt of the request, with training certificate(s) and approval thereof, the Department will issue a username and password to each of the authorized Contractor personnel. The Contractor will ensure that only authorized Contractor personnel access and utilize the control system in a responsible and non-destructive manner. The Contractor shall make every reasonable effort to prevent the disclosure of access information for unauthorized use of the control system. The Department, at its discretion, may revoke access authorization from any user if it is determined that the user: a) has used the control system for any other reason then is intended by this specification, b) is no longer in the Contractor's employ or associated with the project, or, c) has disclosed their access authorization for use by another person or party for any reason. The Contractor is responsible to ensure their authorized users have access to the public internet from a computer system running any currently supported Microsoft Windows Operating System and Microsoft Internet Explorer Web Browser with a minimum Cipher Strength of 128 bit, version 8.0 or higher. Minimum modem speed shall be 768K (business DSL). The Contractor is responsible to ensure that anti-virus software is installed and maintained on any computer accessing the Department's document control system. Additionally, it is the Contractor's sole responsibility to maintain a compatible software system. Compatibility is defined as the ability to send and receive documents in a format viewable by the Department. The Contractor must provide valid individual email addresses for each authorized user to the Department based upon a MAPI compliant email system, such as Microsoft Outlook or Exchange.

Training Requirements: Contractor personnel accessing the document control system must fulfill minimum training requirements as follows: personnel must attend a two (2) day project specific PMWEB training class provided by PMWEB, 300 Trade Center 128,Woburn, MA 01801, (Tel 617-207-708, Web site: www.pmweb.com). The Contractor must supply an acceptable training facility within 15 miles of the project site. Training facility shall have a computer workstation for each student in addition to a computer for the instructor. The instructor computer must be able to project to a screen/wall for classroom illustrations via a digital projector or large screen monitor (Minimum 40"). The computer workstations must be a minimum Pentium 2 GHz with 512MB of RAM, contain 200MB free disk space, and run

Windows XP/Vista. Additional workstation requirements include, at a minimum, Microsoft TCP/IP networking protocol and a valid IP address, Microsoft Internet Explorer 7.0, 24-bit or higher color video, and 1028X764 video resolution.

Any additional training required as a result of adding additional, or replacing existing, Contractor staff, including additional costs associated with meeting hardware requirements to run the latest version of the software at that time, shall be included in the total cost of this item.

Submittals: Within thirty (30) calendar days after award, the Submittal Coordinator shall prepare, in accordance with all requirements of this specification, and submit for review and acceptance, a Submittal Forecast and shall have the following requirements attached:

- Submittal Packages Summary Report
- Submittal Bar Chart Report

Method of Measurement: Within ten (10) calendar days of the award of the Contract, the Contractor shall submit to the Engineer for approval a cost breakdown of his lump sum bid price. The submission must include substantiation showing that the costs breakdown submitted are reasonable based on the Contractor's lump sum bid. The cost breakdown shall be in accordance with the following payment schedule:

1) The cost to successfully complete all preparation and training to utilize the document control system in accordance with these specifications. The preparation and training costs shall not exceed 25% of the total cost of the item and shall include costs to establish customized forms or reports, back enter and scan all contract documentation prior to the access authorization, and to furnish and install all specified hardware.

2) The development cost to prepare the Submittal Forecast in accordance with these specifications shall not exceed 10% of the total cost of the item. Payment for this work will be made upon acceptance of the Submittal Forecast by the Engineer.

   The cost to provide services of the Document Control Specialist, including costs to maintain the Submittal Forecast; Coordinating the Document Control System submittal information with the CPM Schedule submissions; preparing, submitting, utilizing, maintaining, coordinating and updating document control system items as required by all Contractor personnel with access rights to the system shall be paid as a per month cost and shall be derived by taking this cost divided by the number of contract months.

Basis of Payment: This service shall be paid for at the contract lump sum price for "Document Control Specialist" complete, which price shall include the training, preparation, statusing, electronically scanning, filing, and sending all project correspondence, and the furnishing, maintenance, and supply costs for all required hardware, software, and services as noted above in the utilization of the document control system as established and maintained by the Department. The lump sum price will be certified for payment as described in "Method of Measurement" subject to the following conditions:

1) Failure by the Contractor to utilize and regularly update the specified PMWEB database in a manner acceptable to the Department or failure to utilize the common file server for the storage of all project related files may result in the withholding of all contract payments until such time as all specification requirements have been satisfied. Failure by the designated Document Control Specialist to update submittal statuses on a regular basis shall result in the replacement of the Document Control Special at the Engineer's request. Additionally, the Contractor may be found in violation of Article 1.02.02 of the Standard Specifications "for having failed to prosecute work continuously, diligently and cooperatively in an orderly sequence".

2) In the event the project extends beyond the original completion date by more than thirty (30) calendar days, and a time extension is granted to the Contractor, the Department may require the continued utilization of the Document Control System which shall be paid at the per month cost for the services of the Document Control Specialist.

Pay Item	Pay Unit
Document Control Specialist	L.S.

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes for the following:

1. Footings
2. Foundation walls
3. Slabs-on-grade
4. Columns

B. Related CSI Sections include the following:

1. Division 05 Section 055000, “Metal Fabrications” for furnishing metal embedment.
2. Division 07 Section 071113, “Bituminous Damp-proofing” for perimeter damp-proofing.
3. Division 07 Section 079200, “Joint Sealants” for expansion joint over one inch and perimeter and joint sealants for wall joints.
4. Division 13 Section 133419, “Metal Building Systems” for furnishing anchor rods.

1.2 SUBMITTALS:

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, colored hardener and others if requested by the Designer.

C. Shop Drawings: For reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 Detailing Manual – SP-66(94) showing bar schedules, stirrup spacing, bent bar diagrams, splices and laps and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

D. Quality Assurance Submittals:

1. Laboratory test reports for concrete materials and mix design test.

2. Material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
3. Evidence that concrete materials have been tested and the test results are on file with the State of Connecticut Department of Transportation Laboratory.
4. Certified Materials Test Reports for each lot of reinforcement showing that it complies with ASTM A 615.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. State of Connecticut Department of Transportation "Form 816," "Standard Specification for Roads, Bridges and Incidental Construction"
2. ACI 301, "Specifications for Structural Concrete for Buildings."
3. ACI 318, "Building Code Requirements for Reinforced Concrete."
4. CRSI, "Manual of Standard Practice."
5. ACI 315, "Details and Detailing of Concrete Reinforcement"
6. ACI 347, "Recommended Practice for Concrete Formwork"
7. ACI 304R, "Recommended Practice for Measuring, Mixing, Transportation and Placing Concrete"
8. ACI 302.1R, "Guide for Concrete Floor and Slab Construction"
9. ACI 305R, "Hot Weather Concreting"
10. ACI 306R, "Cold Weather Concreting"
11. ACI 306.1, "Standard Specifications for Cold Weather Concreting"
12. ACI 308, "Standard Practice for Curing Concrete"
13. 309R "Standard Practice for Consolidating of Concrete"
14. ACI 211.1, "Standard Practice for Selecting Proportions for Normal, Heavy Weight and Mass Concrete"
15. ACI 303.1 "Standard Specifications for Cast-In-Place Architectural Concrete"
16. ASTM C309 "Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete"
17. ASTM C494 "Standard Specifications for Chemical Admixtures for Concrete"

B. Testing Agency Qualifications: An independent agency, acceptable to the Engineer to perform material evaluation tests and to design concrete mixes, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Materials and installed work may require testing and re-testing at any time during progress of work. Tests, including re-testing of rejected materials for installed work, shall be done at the Contractor's expense.

D. Concrete Testing Service: Engage a qualified independent testing agency, acceptable to the Engineer, to perform material evaluation tests and to design concrete mixtures. The Engineer or his designated representative will perform material evaluation tests on the concrete mixes designed by the Contractor.

E. Conduct a Pre-Installation Meeting at the Project Site in compliance with the requirements of Form 816 Article 1.20-1.05.24, subsection 2.

1. Conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend the meeting.

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures and color hardener through one source from a single manufacturer in accordance with Form 816 Article 1.20-1.06.01.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

B. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963.

C. Water-stops: Store water-stops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS:

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel type material that will provide continuous, true, and smooth,

exposed concrete surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on the plans.

1. Use overlaid plywood complying with DOC PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I or better.
2. Use plywood complying with DOC PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Comply with local regulations controlling use of volatile organic compounds (VOC's).

E. Form Ties: Factory-fabricated, adjustable length, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Provide units that will leave no corrodible metal closer than 1-1/2 inches to the plane of the exposed concrete surface.
2. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.

2.2 STEEL REINFORCEMENT:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A 775, with less than 2 percent damaged coating in each 12-inch bar length.

2.3 REINFORCEMENT ACCESSORIES:

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy-coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or pre-cast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS:

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type 1 or II, gray. Do not use air entraining cement.
2. Fly Ash: ASTM C618, Type C or F.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Provide evidence that all aggregates are non-reactive with alkalines when tested in accordance with ASTM C 289 and C 227.
3. Local aggregates not complying with ASTM C 33 that has been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to the Engineer.

C. Water: ASTM C 94, clean and potable.

2.5 ADMIXTURES:

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

C. Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.6 WATERSTOPS:

A. Flexible PVC Water-stops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory-fabricate corners, intersections, and directional changes. Size to suit joints.

1. Profile: Flat, dumbbell with center bulb.

2.7 CURING MATERIALS:

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry. No curing membranes can be used on slabs-on grade and slab above the basement.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating**,** certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.8 RELATED MATERIALS:

A. Expansion and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A Shore Durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Penetrating Sealer: All vertical concrete wall surfaces facing the interior of the salt containment structures, from top of footing to top of wall, shall receive a coating of penetrating sealer applied in accordance with manufacturer's written instructions. Also, the tops of interior concrete partition walls in salt shed shall likewise be coated. Provide certification by manufacturer that product complies with local regulations controlling the use of volatile organic compounds (VOC). Available Products include, but are not limited to the following:

1. Hydrozo Silane 40M and Hydrozo Enviroseal 40 by Hydrozo.

2. Chem-Trete BSM 40 by Huls-America.

3. Masterseal SL40 by Master Builders.

4. Penetrating Sealer 40 - by Sonneborn Building Products.

F. Granular Fill and Compacted Granular Fill: Refer to Form 816, Section 2.13 "Granular Fill" for material required under all footings and slabs.

G. Anchoring Material: Chemical compounds of polyesters, vinylesters or epoxies used for installation of steel dowels or threaded anchor rods and inserts into new or existing concrete.

2.9 CONCRETE MIXTURES, GENERAL:

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash: 15 percent. Not allowed in cement mixes for slab-on-grade.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions and only when approved by the Engineer.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, except footings, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use non-chlorine accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F.
4. Corrosion-inhibiting admixture for salt shed stems and piers shall contain calcium nitrite at 4 gal. per cubic yard of a 30 percent solid solution.

No admixtures containing calcium chloride shall be permitted in slabs-on-grade and other concrete floors.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS:

A. Footings, Piers and Grade Beams: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days and 5000 psi at 28 days for concrete exposed to chlorides from deicing chemicals and salt .
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: not less than 1 inch and not more than 3 inches before adding high-range water-reducing admixture or plasticizing admixture.
4. Air Content**:** 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days and 5000 psi at 28 days for concrete exposed to chlorides from deicing chemicals and salt.

2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: not less than 1 inch and not more than 3 inches before adding high-range water-reducing admixture or plasticizing admixture.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

2.11 FABRICATING REINFORCEMENT:

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING:

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
2. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
3. For mixer capacity of 1 cu. yd or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixer capacity larger than 1 cu. yd, increase mixing time by 15 seconds for each additional 1 cu. yd.
4. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 – EXECUTION

3.1 FORMWORK:

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for concrete surfaces exposed to view.
2. Class B, 1/4 inch for other concrete surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Chamfer exterior corners and edges of permanently-exposed concrete.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS:

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND RE-USING FORMS:

A. General: Formwork for sides of walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be re-used in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 VAPOR RETARDERS:

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturers recommended tape.

3.5 STEEL REINFORCEMENT:

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.6 JOINTS:

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS:

A. Flexible Water-stops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed water-stops during progress of the Work. Field-fabricate joints in water-stops according to manufacturer's written instructions.

3.8 CONCRETE PLACEMENT:

A Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project Site, or during placement unless approved by the Engineer.

C. Before test sampling and placing concrete, water may be added at Project Site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen sub-grade or on sub-grade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and sub-grade just before placing concrete. Keep sub-grade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES:

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and other defects. Repair tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view or not to be covered with a coating or covering material applied directly to concrete.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view**,** or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, damp-proofing, veneer plaster, or painting.

C. Rubbed Finish: Apply the following to smooth-formed finish and exposed-to-view concrete.

1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 MISCELLANEOUS CONCRETE ITEMS:

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.11 CONCRETE PROTECTING AND CURING:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing. Do not use curing membranes on slabs-on-grade and concrete floors generally in areas of etched floors.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding and bull-floating or darbying concrete, but before float-finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

   a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound

manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.12 CONCRETE SURFACE REPAIRS:

A. Defective Concrete: Repair and patch defective areas when approved by the Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/4 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

E. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.13 FIELD QUALITY CONTROL:

A. Testing and Inspecting: The State will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.

2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd. , plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified

compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

9. Test results shall be reported in writing to the Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract.

END OF SECTION 033000

SECTION 061500 - WOOD DECKING

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes the following:

1. Solid-sawn roof decking.
2. Glued-laminated wood roof decking.

B. Related CSI Sections include the following:

1. Division 06 Section 061000, "Rough Carpentry" for dimension lumber items associated with wood decking.

1.2 SUBMITTALS:

A. Submit the following in accordance with Form 816, Article 1.20-1.05.02 and NOTICE TO CONTRACTOR-SUBMITTALS.

B. Product Data:

1. For glued-laminated wood decking. Include installation instructions and data on fabrication.
2. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treatment plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

a. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before further fabrication or shipment to Project site.

3. For sealant and installation adhesive.

C. Research/Evaluation Reports: For glued-laminated wood decking indicated to be of diaphragm design and construction.

1.3 QUALITY ASSURANCE:

A. Standard for Solid-Sawn Wood Decking: Comply with AITC 112, "Standard for Tongue-and-Groove Heavy Timber Roof Decking."

B. Forest Certification: Provide wood decking produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, “Principles and Criteria”.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Schedule delivery of wood decking to avoid extended on-site storage and to avoid delaying the Work.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood decking with surfaces that are to be exposed in the final work protected from exposure to sunlight.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL:

A. General: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

B. Grade Stamps: Provide solid-sawn wood decking with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, species, grade, moisture content at time of surfacing, and mill. Apply grade stamp to surfaces that will not be exposed to view.

C. Moisture Content: Provide wood decking with 19 percent maximum moisture content at time of dressing.

D. Preservative Treatment: Provide preservative-treated structural glued-laminated timber. Pressure treat lumber before gluing according to AWPA C28 for aboveground use.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction.
2. Use preservative solution without substances that might interfere with application of indicated finishes.

2.2 SOLID-SAWN WOOD DECKING:

A. Decking Species: Balsam fir, Douglas fir-larch, Douglas fir-larch (North), hem-fir, hem-fir (North), southern pine, spruce pine-fir (North), western hemlock, or western hemlock (North).

B. Decking Grade: Selected Decking.

C. Face Surface: Smooth.

D. Edge Pattern: Vee grooved.

2.3 GLUED-LAMINATED WOOD DECKING:

A. Face Species: Douglas fir-larch or Douglas fir-larch North, Ponderosa pine, Southern pine, Western cedars or western cedars North.

B. Decking Nominal Size: As indicated on plans.

C. Decking Configuration: For glued-laminated wood decking indicated to be of diaphragm design and construction, provide tongue-and-groove configuration that complies with research/evaluation report.

D. Face Grade: Service or better: Face knot holes, stain, end splits, skip, roller split, planer burn, and other nonstrength-reducing characteristics are allowed. Strength-reducing characteristics are not allowed.

E. Face Surface: Smooth.

F. Edge Pattern: Vee grooved.

G. Adhesive: Wet-use type complying with ASTM D 2559.

1. Use adhesive that contains no urea-formaldehyde resins.

2.4 FASTENERS AND ACCESSORY MATERIALS:

A. Fasteners for Solid-Sawn Decking: Provide fastener size and type complying with decking standard for thickness of deck used.

B. Fasteners for Glued-Laminated Decking: Provide fastener size and type complying with requirements for installing laminated decking in Part 3.2 "Installation."

C. Fastener Material: Hot-dip galvanized.

D. Installation Adhesive: For glued-laminated wood decking indicated to be of diaphragm design and construction, provide adhesive that complies with research/evaluation report.

1. Use adhesive that has a VOC content that complies with local regulations when calculated according to 40 CRF 59, Subpart D (EPA Method 24)..

E. Penetrating Sealer: Clear sanding sealer complying with CSI Division 09 painting Sections and compatible with topcoats specified for use over it.

2.5 FABRICATION:

A. Shop Fabrication: Where preservative-treated decking is indicated, complete cutting, trimming, surfacing, and sanding before treating.

B. Predrill decking for lateral spiking to adjacent units to comply with referenced decking standard.

C. Seal Coat: After fabricating and surfacing decking, apply a saturation coat of penetrating sealer.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine walls and support framing in areas to receive wood decking for compliance with installation tolerances and other conditions affecting performance of wood decking.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. Install solid-sawn wood decking to comply with referenced standard.

B. Install laminated wood decking to comply with manufacturer's written instructions.

1. Nail each course of glued-laminated wood decking at each support with one nail slant nailed above the tongue and one straight nailed through the face.

2. Glue adjoining decking courses together by applying a 3/8-inch bead of adhesive on the top of tongues according to research/evaluation report.

C. Where preservative-treated decking must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.

D. Apply joint sealant to seal roof decking at exterior walls at the following locations:

1. Between decking and supports located at exterior walls.
2. Between decking and exterior walls that butt against underside of decking.
3. Between tongues and grooves of decking over exterior walls and supports at exterior walls.

3.3 ADJUSTING:

A. Repair damaged surfaces and finishes after completing erection. Replace damaged decking if repairs are not approved by Engineer.

3.4 PROTECTION

A. Provide temporary waterproof covering to protect exposed decking before applying roofing.

END OF SECTION 061500

SECTION 061800 - GLUED-LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes framing using structural glued-laminated timbers.

B. Related CSI Sections include the following:

1. Division 06 Section 061000, "Rough Carpentry" for dimension lumber items associated with structural glued-laminated timber construction.
2. Division 06 Section 061500, "Wood Decking" for wood roof decking.

1.2 DEFINITIONS:

A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

1.3 SUBMITTALS:

A. Submit the following in accordance with Form 816, Article 1.20-1.05.02 and NOTICE TO CONTRACTOR-SUBMITTALS.

B. Product Data: For structural glued-laminated timber and connectors.

1. Include data on lumber, adhesives, fabrication, and protection.
2. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treatment plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated materials.
3. Include installation instructions for timber connectors.

C. Shop Drawings: Show layout of structural glued-laminated timber system and full dimensions of each member. Indicate species and laminating combination, adhesive type, and other variables in required work.

1. Include large-scale details of connections.
2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer, registered in the State of Connecticut, responsible for their preparation.

D. Qualification Data: For manufacturer.

1.4 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Provide factory-glued structural units produced by an AITC- or APA-licensed firm.

1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA trademark. Place mark on surfaces that will not be exposed in the completed Work.

B. Quality Standard: Comply with AITC A190.1, "Structural Glued Laminated Timber."

C. Forest Certification: Provide structural glued-laminated timber produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

1.5 DELIVERY, STORAGE, AND HANDLING:

A. General: Comply with provisions in AITC 111, "Recommended Practice for Protection of Structural Glued Laminated Timber during Transit, Storage, and Erection."

B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

PART 2 - PRODUCTS

2.1 STRUCTURAL GLUED-LAMINATED TIMBER:

A. General: Provide structural glued-laminated timber that complies with AITC 117--MANUFACTURING or research/evaluation reports acceptable to authorities having jurisdiction.

1. Provide structural glued-laminated timber made from a single species.

B. Species and Grades for Structural Glued-Laminated Timber: Provide structural glued-laminated timber made from Alaska cedar, Douglas fir-larch or southern pine, sized as shown on plans, with laminating combinations that meet or exceed stress value for normal loading duration and dry condition of use as shown on the plans.

C. Species and Grades for Beams and Purlins: Provide structural glued-laminated timber that complies with AITC 117--MANUFACTURING or research/evaluation reports acceptable to authorities having jurisdiction and the following:

1. Species and Beam Stress Classification: Douglas fir-larch or southern pine, 24F-1.8E.
2. Lay-up: Either balanced or unbalanced.

D. Species and Grades for Arches: Provide structural glued-laminated timber that complies with AITC 117--MANUFACTURING or research/evaluation reports acceptable to authorities having jurisdiction and the following:

1. Species and Beam Stress Classification: Eastern spruce, 20F-1.5E, Douglas fir-larch or southern pine, 24F-1.8E.
2. Lay-up: Either balanced or unbalanced.

E. Appearance Grade: Premium appearance grade, complying with AITC 110.

F. Preservative Treatment: Provide preservative-treated structural glued-laminated timber. Pressure treat lumber before gluing according to AWPA C28 for waterborne preservatives. Discard pieces affected by treatment that cause a detrimental effect.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction.
2. Use preservative solution without substances that might interfere with application of indicated finishes.

G. Adhesive: Wet-use type complying with ASTM D 2559.

1. Use adhesive that contains no urea-formaldehyde resins.

H. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

I. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.2 TIMBER CONNECTORS:

A. General: Unless otherwise indicated, fabricate from the following materials:

1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36.
2. Round steel bars complying with ASTM A 575, Grade M 1020.
3. Hot-rolled steel sheet complying with ASTM A 1011, Structural Steel, Type SS, Grade 33.

B. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123 or ASTM A 153.

2.3 FABRICATION:

A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.

1. Dress exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.

C. End-Cut Sealing: Immediately after end-cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood-coated for not less than 10 minutes.

D. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.

2.4 FACTORY FINISHING:

A. Clear Finish: Manufacturer's standard, two-coat, clear conversion varnish finish; oven dried and resistant to mildew and fungus.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of structural glued-laminated timber.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. General: Erect structural glued-laminated timber true and plumb, with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

1. Lift with padded slings and protect corners with wood blocking.
2. Install structural glued-laminated timber to comply with Shop Drawings.
3. Install timber connectors as indicated.

B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

3.3 ADJUSTING:

A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by the Engineer.

3.4 PROTECTION:

A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose including protection from weather, sunlight, soiling, and damage from work of other trades.

1. Coordinate wrapping removal with finishing work specified in CSI Division 09. Retain wrapping where it can serve as a painting shield.

END OF SECTION 061800

SECTION 073129 - WOOD SHINGLES AND SHAKES

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes the following:

1. Wood shingle walls.
2. Felt underlayment.

B. Related CSI Sections include the following:

1. Division 06 Section 061000, "Rough Carpentry" for wood wall corner trim.
2. Division 07 Section 076200, "Sheet Metal Flashing and Trim" for flashing and other sheet metal work.

1.2 DEFINITIONS:

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.3 SUBMITTALS:

A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

B. Product Data: For each type of product indicated. Include manufacturers' product specifications, standard details, dimensions, and general recommendations, as applicable to materials and installation.

C. Shop Drawings: For locations and details of wood shingles and sheet metal flashing and counterflashing terminations and transitions, including dimensions and profiles.

D. Product Samples for Verification: For the following products, of sizes indicated, to verify color selected. Full size, of each exposed product for each color, style, and texture required for Project.

1. Wood Shingles: Full size.
2. Underlayment: 12 inches square.

E. Qualification Data: For Installer.

~~F. Quality Assurance Submittals:~~

~~1. Research/Evaluation Reports: For fire-retardant-treated wood shingles available from the treatment company.~~

1.4 QUALITY ASSURANCE:

A. Installer Qualifications: A qualified installer who is an approved affiliate member of CSSB.

B. Grading Agency Qualifications: An independent testing and inspecting agency recognized by authorities having jurisdiction as qualified to label wood shingles for compliance with referenced grading rules.

C. Source Limitations: Obtain wood shingles through one source from a single manufacturer in accordance with Form 816 Article 1.20-1.06.01.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.6 PROJECT CONDITIONS:

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.7 SPARE PARTS:

A. Furnish to the Engineer spare parts described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wood Shingles: Furnish shingles equal to 2% of amount installed, but not less than 1 square identical to those installed in unbroken bundles.

PART 2 - PRODUCTS

2.1 WALL SHINGLES:

A. Cedar Wall Shingles: Smooth-sawn western red cedar shingles.

1. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
2. Grade: No. 1 Blue Label.
3. Size: 18 inches long; 0.45 inch thick at butt.

2.2 WOOD TREATMENTS:

A. Preservative Treatment: AWPA C34, chromated copper arsenate pressure-treated units, minimum 0.40 lb/cu. ft.

B. Identification: Attach a label to each bundle of shingles; identify manufacturer, references to model-code approval, type of product, grade, dimensions, and approved grading agency.

1. Include chemical treatment, method of application, purpose of treatment, and warranties available.

2.3 UNDERLAYMENT MATERIALS:

A. Roof Felt Underlayment: ASTM D 226, Type II, asphalt-saturated organic felt.

2.4 ACCESSORIES:

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Nails: ASTM F 1667; stainless-steel Type 304 or 316 wire nails, sharp-pointed, and of sufficient length to penetrate a minimum of 3/4 inch into sheathing.

1. Use box-type nails for wood shingles.
2. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

C. Felt Underlayment Nails: stainless-steel, wire nails with low-profile capped heads or disc caps, 1-inch minimum diameter.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through roofing.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION:

A. Single-Layer Felt Underlayment: Install single layer felt underlayment horizontally, starting at the base of the wall, with a 2" horizontal overlap with each succeeding course, and a 6" overlap vertically when starting a new roll. Wrap underlayment 4" each way around both inside and outside corners. Fasten with felt underlayment nails.

3.3 METAL FLASHING INSTALLATION:

A. General: Install metal flashings and other sheet metal to comply with requirements in CSI Division 07 Section 076200, "Sheet Metal Flashing and Trim."

1. Install metal flashings associated with doors, windows, and penetration details in accordance with good building practice and as indicated on the plans, if applicable.

3.4 WALL SHINGLE INSTALLATION, SINGLE COURSED:

A. Install wood wall shingles according to manufacturer's written instructions and recommendations in CSSB's "Design and Application Manual for Exterior and Interior Walls."

B. Install wood shingles, beginning at base of wall, with a double-layer starter course in a continuous straight line. Offset joints of double-layer starter course a minimum of 1-1/2 inches.

1. Extend starter course 1 inch below top of foundation wall.
2. Extend outer course 1/2 inch lower than the inner course.

C. Install first course of wood shingles over starter course. Install second and succeeding courses of wood shingles, offsetting joints between shingles in succeeding courses a minimum of 1-1/2 inches.

1. Install shingles in continuous straight-line courses.
2. Space shingles 1/8 to 1/4 inch apart.
3. Fasten each shingle with 2 concealed nails**,** spaced 3/4 to 1 inch from edge of shingle and 1 inch above butt line of subsequent course. For shingles wider than 8 inches add 2 concealed fasteners to the center of shingle spaced 1 inch apart. Drive fasteners flush with top surface of shingles without crushing wood.
4. Maintain weather exposure of 5 inches for 18-inch long shingles.
5. Interior Corner Treatment: Butted against wood stop.
6. Exterior Corner Treatment: Butted against corner boards.

END OF SECTION 073129