

Technical Specifications

**Mountain View Lake Dam
Bellmont, New York
NYS ID No. 182-0276**

Mountain View Lake Dam Reconstruction

Prepared for:

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APRIL 27, 2018

60% Design - Not For Construction

Mountain View Lake Dam Reconstruction
Town of Bellmont, New York

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SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Demolition of existing structures as shown on the drawings. Demolition shall include fracturing, loosening, removing and disposing of existing concrete, timber, steel, masonry, mortar, concrete and reinforcement at the locations shown on the drawings and as directed by the Owner's Representative. All demolition materials shall be disposed of at an approved off-site location unless otherwise approved.
- B. Demolition, modifications and removals which may be specified under other Sections shall conform to requirements of this Section.
- C. Demolition and modifications shall include:
 - 1. Removal of existing timber crib dam.
 - 2. Removal of existing concrete gate structure
 - 3. Removal of existing dam abutments
 - 4. Removal of other structures as indicated on the drawings.
- D. Blasting and the use of explosives will not be permitted for any demolition work.

1.02 RELATED WORK

- A. Submittals are included in Section 01300.
- B. Riprap are included in Section 02271.

1.03 SUBMITTALS

- A. Any required permits for disposal of debris.
- B. Submit, in accordance with Section 01300, three copies of the proposed methods and operations of demolition of the structures and modifications prior to the start of work. Include removal procedures and operational sequence for review and approval by Owner's Representative.
- C. Submit shop drawings which indicate demolition and removal sequence and location of salvageable items. Include proposed method of demolition and provisions for erosion, dust and noise control.
- D. Submit description of salvaged materials. Materials must be approved by the Owner's Representative prior to placement onsite.

1.04 JOB CONDITIONS

A. Protection

1. Execute the demolition and removal work to prevent damage or injury to structures, occupants thereof and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.
2. Closing or obstructing of roadways, sidewalks, and passageways adjacent to the work by the placement or storage of materials will not be permitted and all operations shall be conducted with a minimum interference to traffic on these ways.
3. Prevent material from damaging or impeding roadways.

B. Notification

1. At least 48 hours prior to commencement of demolition or removal, notify the Owner's Representative in writing of proposed schedule therefor. No removals shall be started without the permission of the Owner's Representative.

C. Conditions of Structures

1. The Owner and the Owner's Representative assume no responsibility for the actual condition of the structures to be demolished or modified.
2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within a structure may occur prior to the start of demolition work.

D. Repairs to Damage

1. Promptly repair damage to any adjacent structure caused by demolition operations. Repairs shall be directed by the Owner's Representative and shall be performed at no cost to the Owner. Repairs shall be made to the condition at least equal to that which existed prior to construction.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. None required.

PART 3 - EXECUTION

3.01 REMOVAL METHODS

- A. Contractor may use any method except explosives or chemical agents provided his operations do not damage any portion of the structure that is to remain in place. All damage to existing structures which are to remain in place shall be repaired by the

Contractor at his own expense.

- B. Removal shall be to the lines and elevations indicated on the drawings or as directed by the Owner's Representative.
- C. Embedded metalwork and/or steel reinforcement may be encountered in portions of concrete and masonry to be removed and shall be included in the unit or lump sum prices bid for the work. No additional compensation will be allowed for the removal of concrete containing these materials.

3.02 DISPOSAL

- A. Salvageable material and equipment shall become the property of the Owner. Dismantle all such items to a size that can be readily handled and deliver them to a designated storage area.
- B. Salvaged stone riprap, meeting the requirements specified in Section 02271, shall be stockpiled on-site for installation downstream of the proposed new dam.
- C. All other material shall become the Contractor's property and must be removed from the site
- D. The storage or sale of removed items on the site will not be allowed.

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END OF SECTION

SECTION 02100

DIVERSION AND CARE OF WATER

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall be responsible for the control of river water, ground water and surface water during construction.
- B. The Contractor shall be responsible for the design, scheduling, installation, maintenance, monitoring and removal of all temporary pre-fabricated cofferdams and dewatering systems required during the course of construction.
- C. Design, schedule, install, maintain, monitor and remove all silt barriers, holding, pumping and sedimentation facilities necessary or required to dewater, divert, remove, treat and dispose of water in the construction areas.
- D. The work shall include:
 - 1. Removal of silt, debris and other unsuitable foundation materials existing at the location of the cofferdams to ensure a watertight seal at the foundation. Such excavated material is to be disposed of off-site at an upland location in accordance with applicable permit requirements.
 - 2. The installation of granular fill or pre-fabricated cofferdams to provide for dewatering.
 - 3. Daily inspection, monitoring, maintenance, and repair of all pre-fabricated cofferdams.
 - 4. The removal and disposal of all cofferdam materials upon completion of the work.
 - 5. All dewatering operations shall be the responsibility of the Contractor.

1.02 SUBMITTALS

- A. The Contractor shall submit a detailed schedule for the installation, maintenance and removal of cofferdams to the Owner's Representative for review and approval.
- B. The Contractor shall provide complete cofferdam details including drawings and calculations sealed by an engineer licensed to practice in New York State. Submittal shall include allowable stresses used in the design, working loads and load capacity of all supporting elements. Design loads will be stated on the

drawings. Cofferdam drawings shall be fully detailed, showing all cofferdam elements overlayed onto the site plan, sizes, material specifications and manufacturer's recommendations for installation.

- C. Submission of the cofferdam plan and details shall in no way relieve the Contractor of the full responsibility of the cofferdam.
- D. Submit in accordance with Section 01300, plans, details, and computations for the cofferdam arrangements proposed. Any pre-fabricated cofferdams must be approved by the Owner's Representative and the agencies having jurisdiction over the Work.
- E. During installation and after installation until removal, submit written daily reports (including weekends and holidays) of visual observations and inspections of each cofferdam structure.
- F. Any other information as may be required by the applicable permits or by the Owner's Representative.

1.03 RESPONSIBILITY

- A. Design, layout and installation of all cofferdams and dewatering systems is the responsibility of the Contractor and will be subject to approval by the Owner's Representative and agencies having jurisdiction over the Work.

PART 2 - PRODUCTS

2.01 PRE-FABRICATED COFFERDAM STRUCTURES

- A. Pre-fabricated cofferdam structures, if used, shall be by an approved manufacturer.
- B. Approved manufacturers:
 - 1. Portadam, Inc., 3082 South Black Horse Pike, Williamstown, NJ 08094
 - 2. Approved equal.

PART 3 - EXECUTION

3.01 SCHEDULING

- A. Contractor shall install, maintain, and remove cofferdams in accordance with schedule approved by the Owner's Representative.

3.02 RIVERBED PREPARATION

- A. Remove surface silts, loose material and debris to expose a sound and stable surface subject to approval of Owner's Representative.

3.03 INSTALLATION AND REMOVAL

- A. Extreme care shall be exercised during handling and installation of cofferdams. The Contractor will be required to replace or repair any damaged cofferdams.
- B. Contractor shall install and remove cofferdams in accordance with approved schedule and local, state, and federal permits, as well as the approved cofferdam plan.

3.04 CARE AND HANDLING OF WATER

- A. Contractor shall provide sufficient pumping capacity and standby capacity to handle cofferdam leakage and surface runoff into the work area.
- B. All water pumped from the work area shall be discharged into approved sedimentation control facilities before being discharged into the river.

3.05 SAFETY

- A. Contractor shall maintain the dewatered area in a safe condition. Suitable alarms, means of egress, and other appropriate safety facilities shall be provided.

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END OF SECTION

SECTION 02140

DEWATERING AND DRAINAGE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor is responsible for management of all water from dewatering operations, stormwater, and streamwater when encountered on the site. The Contractor shall prepare an Emergency Response Plan as specified in Section 01170 and may be required, at the Owner's discretion, to stop work and/or remove existing equipment during wet weather events.
- B. The Contractor shall coordinate closely with the Owner and Owner's Representative to schedule any concrete placement or other weather sensitive work so that the work performed occurs during anticipated stretches of dry weather to minimize the chance of work disruption.
- C. Furnish, maintain, and remove temporary surface control measures adequate to drain and remove surface water entering excavations.
- D. Design, furnish, install, operate, monitor, maintain and remove a temporary dewatering system as required to lower and control water levels as necessary below subgrades of excavations and to permit construction to proceed in-the-dry.
- E. Design, furnish, install, operate, monitor, maintain and remove a temporary cofferdam as shown on the drawings, to limit the amount of water entering the site of work from the Mountain View Lake. Cofferdam placement shall be coordinated with the Water Diversion Plan.
- F. Design, furnish, install, operate, maintain, and remove, if necessary all components of the Water Diversion system to maintain water flow from Bound Brook across the dam.
- G. Retain the services of a professional engineer registered in the State of New York to prepare the dewatering, drainage, and diversion pipe system designs and submittals described herein.
- H. Work shall include the design, equipment, materials, installation, protection, and monitoring of geotechnical instrumentation required to monitor the performance of the dewatering, drainage, and diversion pipe systems as required herein.
- I. Collect and properly dispose of all discharge water from the dewatering, drainage, and diversion pipe systems in accordance with the provisions of Section 01110. Under no circumstances shall water be discharged into the existing or new sanitary sewer systems.

- J. Obtain and pay for all permits required for dewatering, drainage, and diversion pipe systems.
- K. Repair damage caused by dewatering, drainage, and diversion pipe system operations.

1.02 SUBMITTALS

- A. Submit a Dewatering Plan to the Owner's Representative for review and approval, that includes the arrangement, locations and details of risers, headers, filters, pumps, power units and discharge lines; and means of discharge, control of sediment, and disposal of water.
 - 1. Include layouts of flow-measuring devices for monitoring performance of dewatering system.
 - 2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
 - 3. Include the anticipated area influenced by the dewatering system and address impacts to adjacent existing and proposed structures.
 - 4. Coordinate Dewatering Plan submittals with the excavation, Water Diversion Plan and Cofferdam submittals.
- B. Submit a Water Diversion Plan to the Owner's Representative for review and approval. The plan shall include the Contractor's proposed means and methods for the collection, conveyance, and ultimate discharge of all water from the water diversion system.
 - 1. Coordinate Water Diversion submittals with the excavation, dewatering and drainage and cofferdam submittals.
- C. Dewatering, drainage and water diversion systems shall be prepared by a licensed professional engineer in the State of New York retained by the Contractor. Submit in accordance with Section 01300 qualifications for the licensed professional engineer. The Contractor shall also submit qualifications as required herein.
- D. Do not proceed with any excavation, dewatering, or water diversion activities until the dewatering submittals have been approved by the Owner's Representative.

1.03 QUALITY ASSURANCE

- A. The Contractor shall have at least 5 years of experience with work compatible to the Work shown and specified, employing labor and supervisory personnel who are similarly experienced in this type of Work. An experienced installer that has specialized in design of dewatering systems and dewatering work.

- B. All work shall comply with governing EPA, NHDES, and local notification regulations before beginning dewatering and shall comply with hauling and disposal regulations of authorities having jurisdiction.

1.04 DEFINITIONS

- A. The phrase “in-the-dry” shall be defined as an excavation subgrade where the groundwater has been lowered at least 2 feet below the lowest level of the excavation and is stable with no ponded water, mud or muck, is able to support construction equipment without rutting or disturbance and is suitable for the placement and compaction of fill material, pipe or concrete foundations.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Piping, pumping equipment and all other materials required to provide control of surface water and groundwater in excavations shall be suitable for the intended purpose.
- B. Standby pumping systems and a source of standby power shall be maintained at all sites.

PART 3 - EXECUTION

3.01 DESIGN REQUIREMENTS

- A. The Contractor is responsible for the proper design and implementation of methods for controlling surface water, groundwater, and streamwater.
- B. The primary purpose of the groundwater control system is to preserve the natural undisturbed condition of the subgrade soils in the areas of the proposed excavations. The Contractor is responsible for lowering the groundwater as necessary to complete construction in accordance with the plans and specifications at no additional cost to the Owner.
- C. Design deep wells, well points and sumps, and all other groundwater control system components to prevent loss of fines from surrounding soils. Sand filters shall be used with all dewatering installations unless screens are properly sized by the Contractor's design engineer to prevent passage of fines from surrounding soils.
- D. The purpose of the diversion pipe system is to maintain flow of Bound Brook while the culvert and control structure are not in service. Contractor is responsible for conveying water from the upstream to downstream side of the dam during construction in accordance with the plans and specifications.
- E. Design diversion pipe system to prevent erosion at both the intake and outlet

points. Diversion pipe shall only convey water from the upstream to downstream side, and water should not travel through the system from downstream to upstream. Riprap aprons, screens, and flap gates shall be used with system unless appropriate alternatives are proposed by the Contractor's design engineer to prevent erosion and maintain proper flow.

- F. The Contractor shall be responsible for damage to properties, buildings or structures, sewers and other utility installations, pavements and work that may result from dewatering, surface water control, or diversion pipe operations.
- G. Design review and field monitoring activities by the Owner or by the Owner's Representative shall not relieve the Contractor of his/her responsibilities for the work.

3.02 GENERAL

- A. Control surface water and groundwater such that excavation to final grade is made in-the-dry, the natural undisturbed condition of the subgrade soils is maintained, and softening and/or instability or disturbance due to the presence or seepage of water does not occur. All construction and backfilling shall proceed in-the-dry and flotation of completed portions of work shall be prohibited.
- B. Excavation work shall begin only after erosion control measures have been installed in accordance with Section 01110 and the site has been prepared in accordance with Section 02100.

3.03 EXCAVATION DEWATERING

- A. At all times during construction, provide and maintain proper equipment and facilities to promptly remove and properly dispose of all water entering excavations. Excavations shall be maintained in-the-dry.
- B. Excavation dewatering shall maintain the subgrade in a natural undisturbed condition and until the fill, structure or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
- C. Pipe, masonry, and concrete shall not be placed in water or be submerged within 24 hours after being installed. Water shall not flow over new masonry or concrete within four days after placement.
- D. In no event shall water rise to cause unbalanced pressure on structures until the concrete or mortar has set at least 24 hours. Prevent flotation of the pipe by promptly placing backfill.
- E. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed condition of the subgrade soils at the proposed bottom of excavation.

- F. If the subgrade of the trench or excavation bottom becomes disturbed due to inadequate dewatering or drainage, excavate below normal grade as directed by the Owner's Representative and refill with structural fill, screened gravel or other material as approved by the Owner's Representative at the Contractor's expense.
- G. It is expected that the initial dewatering plan may have to be modified to suit the variable soil/water conditions to be encountered during construction. Dewater and excavate, at all times, in a manner which does not cause loss of ground or disturbance to the pipe bearing soil or soil which supports overlying or adjacent structures.
- H. If the method of dewatering does not properly dewater the excavation as specified, install additional groundwater observation wells as directed by the Owner's Representative and do not place any pipe or structure until the readings obtained from the observation wells indicate that the groundwater has been lowered as necessary below the bottom of the final excavation within the excavation limits.
- I. Dewatering units used in the work shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from the dewatering system shall be continuous until pipe or structure is adequately backfilled. Stand-by pumps shall be provided.
- J. Water entering the excavation from precipitation or surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to a sump and pumped from the excavation to maintain a bottom free from standing water.
- K. Drainage shall be disposed of in an approved area as specified in Section 01110. Existing or new sanitary sewers shall not be used to dispose of drainage.

3.04 COFFERDAM SYSTEM

- A. At all times when portions of the dam structure are out of service, provide and maintain proper equipment and facilities to maintain conveyance of water across the dam.

3.05 REMOVAL OF SYSTEMS

- A. At the completion of the excavation and backfilling work, and when approved by the Owner's Representative, all pipe, deep wells, wellpoints, pumps, generators, observation wells, other equipment and accessories used for the groundwater and surface water control systems shall be removed from the site. All materials and equipment shall become the property of the Contractor. All areas disturbed by the installation, operation, and removal of groundwater control systems and observation wells shall be restored to their original condition.
- B. At completion of culvert construction and removal of cofferdams protecting

culvert, and when approved by Owner's Representative, all materials and equipment used for diversion pipe system shall be removed from the site. All materials and equipment shall become property of the Contractor. All areas disturbed by the installation, operation, and removal of diversion pipe system shall be restored to their original condition.

- C. Leave in place any casings for deep wells, wellpoints or observation wells located within the plan limits of structures or pipelines or within the zone below 1H:1V planes extending downward and out from the edges of foundation elements or from the downward vertical footprint of the pipe, or where removal would otherwise result in ground movements causing adverse settlement to adjacent ground surface, utilities or existing structures.
- D. Where casings are pulled, holes shall be filled with sand. Where left in place, casings should be filled with cement grout and cut off a minimum of 3-ft below finished ground level or 1-ft below foundation level so as not to interfere with finished structures or pipelines.
- E. When directed by the Owner's Representative, observation wells should be left in place for continued monitoring. When so directed, cut casings flush with final ground level and provide protective lockable boxes with locking devices. The protective boxes shall be suitable for the traffic and for any other conditions to which the observation wells will be exposed.

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END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

- A. The Contractor shall provide all stripping, excavation, fill and backfill required to achieve lines and grades as shown on drawings.

1.02 QUALITY ASSURANCE

- A. Perform all work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Testing and Inspection Services: The Owner's Representative shall be allowed to inspect all backfilled and graded areas and request additional modifications, if required to achieve design grade. The Owner shall employ, at its expense, a testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations. (See 1.03 for testing procedures and standards).

1.03 SUBMITTALS

- A. Submit to the Owner's Representative, in accordance with Section 01300 and the requirements of this Section, complete product data for materials specified in this Section. Data shall be submitted at least 72 hours prior to placement of materials. Product data shall include, at a minimum, source of materials, maximum density, gradation, Atterberg limits, etc. as applicable.

1.04 REFERENCE STANDARDS

- A. ASTM International
 - 1. ASTM D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- B. New York State Department of Transportation Standard Specifications Construction and Materials.
- C. When reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. The Contractor's surveyor shall be a Professional Land Surveyor or Professional Engineer registered in the State of New York and shall have at least five (5) years'

experience in construction survey of the type required under this Contract and acceptable to the Owner's Representative and Owner.

- B. The Contractor shall have at least five (5) years' experience with comparable work (i.e. Dam Safety) shown and specified herein. The Contractor shall employ labor and supervisory personnel who are similarly experienced in this type of work.
- C. The Contractor shall hire a Testing/Inspection Agency to perform testing required as indicated in this Section. The Limits on Testing/Inspection Agency Authority are as follows:
 - 1. The Testing/Inspection Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. The Testing/Inspection Agency may not approve or accept any portion of the work.
 - 3. Testing/Inspection Agency may not assume any duties of Contractor.
 - 4. Testing/Inspection Agency has no authority to stop the work.
- D. The Contractor shall deliver to Testing/Inspection Agency adequate samples of materials proposed to be used which require testing. The Contractor shall cooperate with laboratory personnel, and provide access to the work.
- E. The Contractor shall provide incidental labor and facilities:
 - 1. To provide access to work materials to be tested/inspected.
 - 2. To obtain and handle samples at the site or at source of materials to be tested/inspected.
 - 3. To facilitate tests/inspections.
 - 4. To provide storage of test samples.
- F. The Contractor shall notify the Owner's Representative 24 hours prior to expected time for operations requiring testing/inspection services.
- G. Payment for testing will be made by the Contractor. This includes all re-testing required because of non-conformance to specified requirements. Re-testing due to non-conformance shall be performed by the same agency on instructions by the Owner's Representative.
- H. Make required inspections and test including, but not necessarily limited to:
 - 1. Visually inspect on-site and imported fill and backfill, making such tests and retests as are necessary to determine compliance with the requirements as specified herein.

2. Make field density tests on samples from in-place material as required.
- I. The Contractor is responsible for all construction layout and reference staking necessary for the proper control and satisfactory completion of all structures, cutting, filling, grading, drainage, fencing embankment improvements, curbing and all other appurtenances required for the completion of the construction work and acceptance of the Contract as specified and as shown on the Drawings.
- J. All construction layout and staking shall be performed by a professional land surveyor or professional engineer registered in the State of New York, experienced and skilled in construction layout and staking of the type required under this Contract, and acceptable to the Owner's Representative and Owner.

1.06 JOB CONDITIONS

A. Utilities

1. Contractor shall contact and receive a reply from "Dig Safely New York" before start of construction. Locate any existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.
 - a. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, cease operations and consult utility owner immediately for directions. Cooperate with Owner's Representative and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

B. Protection of Persons and Property

1. Barricade unsafe areas occurring as part of this work and post warning signs. Block temporary access roads while construction is not occurring and post explanatory signs.
 - a. Protect adjacent trees, structures, pavements, and other facilities that will remain, from damage caused by equipment operation, settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

C. The use of explosives is prohibited.

1.07 DEFINITIONS

- A. **Percent Compaction** is the required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material, as determined in the laboratory by ASTM Test Method D1557-78 (Modified Proctor).
- B. **Optimum Moisture Content** is the moisture content (percent by dry weight)

corresponding to the maximum dry density of the same material as determined by ASTM Test Method D1557-78.

- C. **Moisture-Sensitive Soil** is on-site soil containing more than 5 percent fines (silt- or clay-sized particles) based on the fraction passing the 3/4-inch sieve.
- D. **In-the-Dry** is defined as an excavation subgrade where the groundwater level has been lowered to at least 2 feet below the lowest level of the excavation, is stable with no ponded water, mud, or muck and shall be able to support construction equipment without rutting or disturbance and shall be suitable for the placement and compaction of fill material, pipe or concrete foundations.
- E. **Structures** are all buildings, wet wells, manholes and below grade vaults, retaining walls, pipelines and utilities, pavements, structural slabs, slabs-on-grade, and culverts.
- F. **Unsuitable Soil** includes existing fill materials, organic soils, weak native soils, or clays with a plasticity index of greater than 30.
- G. **Objectionable Material** includes topsoil, organic matter, wood, contaminated soil, construction debris, perishable materials, snow, ice, frozen earth, and rocks or lumps of cemented soils over 6 inches in maximum dimension.
- H. **Overexcavation** is removal of Unsuitable Soil or Objectionable Material at or below the normal grade of the excavation or subgrade as indicated on the Drawings.
- I. **Subgrade** is the required surface of subsoil, borrow fill or compacted fill. This surface is immediately beneath site improvements, specially dimensioned fill, paving, or other surfacing material.
- J. **Finished grade** shall mean the required final grade elevation indicated on the Drawings. Spot elevations shall be precedent over proposed contours.
- K. **Coverage** shall mean the pass of compaction equipment over the complete surface area of exposed lift or subgrade to receive compaction.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. Materials designated for use in this Section are specified in Sections 02230, 02271, and 02272.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

- A. Maintain the excavated subgrade “in-the-dry”.

- B. Prior to the placement of fill, remove all objectionable material. Objectional material includes, but is not limited to, pavement, organic soils, topsoil, soft or loose soils, construction debris, frozen soils, contaminated material, snow, ice, rocks or lumps of cemented soils over 6 inches in diameter.
- C. Proof compact the final subgrade using at least 4 coverages of a vibrator plate compactor.
- D. Soft subgrade or unusable material below proposed culvert shall be removed and replaced with flowable fill.
- E. Subgrade surface created in existing soils for placement of structural fill for the new dam slope construction shall be scarified to a minimum depth of six (6) inches prior to placement of fill.
- F. The Contractor shall notify the Owner's Representative to observe the subgrade following subgrade preparation and prior to placement of fill. If the existing subgrade soils are determined to be unsuitable, direction will be provided by the Owner's Representative regarding removal and replacement with suitable materials.
- G. Over-excavation beyond the limits and depths required by the Contract Documents shall be replaced at no additional cost to the Owner by flowable fill below culvert, structural fill on embankments, or other approved material subject to the prior approval of the Owner's Representative.
- H. At all structures, prior to the placement of bedding material, concrete work mats, structural fill or structural concrete, coordinate with the Owner's Representative to verify the suitability of the existing subgrade soil.

3.02 COMPACTION

- A. Before placement of fill, bedding material, concrete work mats, structural fill, or structural concrete, the Owner's Representative shall observe the subgrade and the Contractor shall perform in-place soil density tests as required to confirm that the bearing characteristics of the subgrade are consistent with those anticipated in the geotechnical investigations. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Owner's Representative at no expense to the Owner.
- B. During the placement of bedding material, backfill, the Contractor shall perform in-place soil density tests to verify that the backfill/fill material has been compacted in accordance with the compaction requirements specified in this Section. The Owner's Representative may designate areas to be tested. The Contractor shall notify the Owner's Representative at least 24 hours in advance of the scheduled compaction testing.
- C. Compact soils to the following requirements:

1. Compact each layer of spoils or fill material to 98% of the Modified Proctor maximum density per ASTM D1557.
 2. No density tests are required for gravel base when the moisture content is within the limits for proper compaction. Compact the material in accordance with the requirements of NYDOT Specification 203-3.12.
 3. Perform at least 1 density and moisture content test for each 2,500 square feet minimum of each lift of fill at embankment and structure areas. Perform additional tests as determined by the Owner's Representative.
- D. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
1. Scarify and air-dry soil material that is too wet to permit compaction to specified density.

3.03 BACKFILL AND FILL

- A. Place backfill and fill materials in lifts no more than 6 inches thick.
- B. Frozen, deleterious, or ice-containing material shall not be used as backfill.
- C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification.
- D. Compaction in open areas may be accomplished by any of the following methods: heavy vibratory rollers, mechanical tampers, or another method approved by the Owner's Representative. Compaction in confined areas (including areas within a 45-degree angle extending upward and outward from the base of a wall) and in areas where the use of large equipment is impractical, shall be accomplished by hand operated vibratory equipment or mechanical tampers approved by the Owner's Representative. Lift thickness shall not exceed 6-in (measured before compaction) when hand operated equipment is used. As a minimum, compaction of fills and crushed stone shall consist of at least four coverages of the approved equipment, unless otherwise specified.
- E. Fill and backfill shall not be placed and compacted when the materials are too wet to properly compact (i.e., the in-place moisture content of the soil at that time is no more than three percentage points above the optimum moisture content of that soil as determined by laboratory test ASTM D1557).

3.04 GRADING

- A. Uniformly grade areas within limits of grading as shown on the Drawings, including

adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

- B. All objectionable material encountered within the limits indicated shall be removed and disposed of. Subgrades shall be completely and continuously drained and dewatered throughout the grading process. Install temporary drains, drainage ditches, etc, to intercept or divert surface water which may affect the execution or condition of grading work.
- C. If it is not possible to place any material in its proper section of the Work, it shall be stockpiled in approved areas for later use. No extra payment will be made for the stockpiling or double handling of excavated material.
- D. Stones or rock fragments larger than 2-in in their greatest dimensions will not be permitted within the top 6-in of the finished grade of fills and embankments.
- E. In cut areas, all loose or protruding rocks in slopes shall be removed to line or finished grade of the slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings unless otherwise directed by the Owner's Representative.

3.05 FIELD QUALITY CONTROL

- A. The Owner's Representative shall inspect and approve subgrades and fill layers before further construction work is performed.
- B. If in the opinion of the Owner's Representative, based on inspection, subgrade or fills which have been placed are below specified density, provide additional compaction at no additional expense to the Owner.

3.06 MAINTENANCE

- A. Where settling is measurable or observable at excavated areas within one year of completed placement of materials, remove topsoil, add backfill material, compact, and replace topsoil and reseed. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.07 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Unsuitable, waste and surplus excavated material shall be removed and disposed of off-site.
- B. Suitable fill materials obtained from on-site excavation may be temporarily stockpiled in an area as specified by the Owner that does not disrupt construction activities, create any nuisances or safety hazards, or otherwise restrict access to the work site. Disposal of excess suitable fill will be as directed by the Owner's

Representative. Otherwise all suitable fill will remain the property of the Owner.

- C. Disposal of trees and stumps shall be off-site.
- D. Disposal of all non-earthen materials shall be Contractor's responsibility.
- E. Each Contractor shall provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- F. Contractor shall provide containers with lids. Contractor shall remove litter, debris and other construction waste generated by their work from the site on a regular basis.

* * * * *

END OF SECTION

SECTION 02230

GRANULAR FILL MATERIALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and obtain materials for filling and backfilling, furnishing and placing stone fill, grading and miscellaneous sitework, in accordance with these Specifications and in close conformity with the lines and grades shown on the Drawings or established by the Owner's Representative.

1.02 SUBMITTALS

- A. Submit to the Owner's Representative, in accordance with Section 01300 and the requirements of this Section, complete product data for materials specified in this Section. Data shall be submitted at least 72 hours prior to placement of materials. Product data shall include, at a minimum, source of materials, maximum density, gradation, Atterberg limits, etc. as applicable.

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33 Standard Specification for Concrete Aggregates.
 - 2. ASTM D1557 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2700kN-m/m)).
 - 3. ASTM D2487 Classification of Soils for Engineering Purposes (United Soil Classification System).
 - 4. ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
- B. New York State Department of Transportation Standard Specifications Construction and Materials.
- C. American Association of State Highway and Transportation Officials (AASHTO).
- D. When reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

A. Laboratory Testing

1. Materials to be used in the work shall be tested by a certified independent laboratory, engaged by the Contractor and acceptable to the Owner's Representative, to demonstrate conformance with the requirements of these Specifications. Such testing will be paid for by the Contractor. At least fifteen (15) days prior to the placement of any backfill or fill materials, deliver a representative sample of the proposed materials weighing at least fifty pounds to the soils testing laboratory in accordance with Section 01300. For each source of fill material, the Contractor shall provide written documentation of the source of the fill and certification that the fill material is clean and in compliance with applicable standards and regulations.
2. Testing methods shall comply with the latest applicable ASTM or AASHTO Standards specified.
3. All granular fill materials delivered to the site and used in construction shall be tested for grain size and optimum moisture-maximum density, and reports of the test results for each source shall be submitted before placing materials. In addition, the soils testing laboratory shall perform the following test at a minimum frequency of 1 per every 150 cubic yards (CY) of material or when there is a change in material properties or source:
4. Grain size analyses (ASTM D2488) of samples to determine their suitability for use as backfill or fill material in conformance to the materials requirements specified hereinafter.
5. Proctor analyses (ASTM D1557) to determine the maximum dry densities required for compaction testing as specified elsewhere in the Contract Documents.
6. Test results and determinations of suitability shall be delivered to the Owner's Representative no later than five (5) days prior to the placement of backfill or fill materials.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. If granular fill materials are delivered to the site prior to placement approval, materials shall be stockpiled on site in areas as shown on the Drawings or as directed by the Owner's Representative. Provision shall be implemented to minimize surface water impact on the stockpile. Removal and placement of granular fill material shall be done in a manner to minimize intrusion of soils adjacent to and beneath the stockpile.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. The sources from which the Contractor proposes to obtain the materials required for the work covered in this Section shall be selected well in advance of the time when the materials will be required in the work. Suitable samples of the proposed materials shall be submitted to the Owner's Representative for approval of the quality relative to durability of the rock prior to delivery of any such material to the site of the work. All test samples shall be obtained by the Contractor and delivered at his expense to a point designated by the Owner's Representative. The Owner's Representative will be allowed to examine the stone materials at the source.
- B. Backfill and fill materials shall be suitable excavated materials, natural or processed mineral soils obtained from off-site sources, or graded crushed stone or gravel. Backfill and fill materials shall be free of all organic material, trash, snow, ice, frozen soil, or other objectionable materials which may be compressible or which cannot be properly compacted. Soft, wet, plastic soils which may be expansive, clay soils having a natural, in-place water content in excess of 30 percent, soils containing more than 5 percent (by weight) fibrous organic materials, and soils having a plasticity index greater than 30 shall be considered unsuitable for use as backfill and fill. Backfill and fill materials shall have a maximum of 1 percent expansion when testing is performed on a sample remolded to 98 percent of maximum dry density (per ASTM D1557) at 2 percent below optimum moisture content under a 100 lbs/sq ft surcharge
- C. Select granular fill should be hard, durable, rounded, or subangular particles of proper size and gradation, and should be free from sand, loam, clay, excess fines, and other deleterious materials. Select granular fill shall be used for drainage pipe backfill as detailed and at other locations indicated on the drawings. The material should conform to the following gradation

| Sieve Size (in) | % Passing |
|-----------------|-----------|
| 4 | 100 |
| #40 | 0 to 70 |
| #200 | 0 to 15 |

- D. Riprap is specified in Section 02271.
- E. Crushed stone shall consist of clean, durable, sharp-angular fragments of rock of uniform quality and shall comply with NYSDOTSS Material Designation 703-0201, size designation 2 (1.5-inch minus).
- F. Riprap bedding shall consist of clean, durable, sharp-angular fragments of rock and shall conform to the following gradations.

| Sieve Size (in) | % Passing |
|-----------------|-----------|
| 1 | 90-100 |
| 5/8 | 60-100 |
| 1/8 | 15-50 |

| | |
|------|------|
| #25 | 0-10 |
| #200 | 0-5 |

- G. Structural fill shall be gravel, sandy gravel, or gravelly sand free of organic material, loam, wood, trash, snow, ice, frozen soil and other objectionable material and shall be graded within the following limits:

| Sieve Size (in) | % Passing |
|-----------------|-----------|
| 3 | 100 |
| #4 | 20-70 |
| #40 | 3-35 |
| #200 | 0-10 |

- H. Common fill shall consist of mineral soil, substantially free of clay, organic material, loam, wood, trash, snow, ice, frozen soil and other objectionable material which may be compressible, or which cannot be compacted properly. Common fill shall not contain stones larger than 6-in in any dimension and not more than 30 percent will pass a No. 200 sieve. It shall not contain broken concrete, masonry, rubble, asphalt pavement, or other similar materials. It shall have physical properties, as approved by the Owner's Representative, such that it can be readily spread and compacted.
- I. Cushion sand shall consist of clean, hard, durable, uncoated particles, free from lumps of clay and all deleterious substances. The cushion sand shall comply with NYSDOTSS Material Designation 703-06 Cushion Sand.
- J. Geotextile fabric shall meet the requirements of Section 02272.

PART 3 - EXECUTION

3.01 NOT USED

* * * * *

END OF SECTION

SECTION 02260

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes temporary excavation support and protection systems.

1.02 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
- B. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated. The professional engineer shall be certified in New York State with a minimum of 5 years' experience with similar projects.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300 Shop Drawings for excavation support and protection system. Shop Drawings shall include the following:
 - 1. Provide overall plan layout of the system, indicating clearances, dimensions, material properties, member sizes, locations, spacing and penetrations depth of all members, locations of various types of lateral supports. Indicate existing and proposed utilities, structures or other obstructions, location and type of instrumentation and monitoring points within the area of influence of the excavation.
 - 2. Provide wall elevations and locations of all bracing.
 - 3. Show the methods and overall sequence of installation and removal of excavation supports and bracing, indicating levels to which the work will be carried out before excavation support or bracing is installed or removed.
 - 4. Method of preloading bracing (if required) and the preload for each member, and the method of locking-off the preload. Include detailed drawings of the connections, jacking supports and method of shimming.
 - 5. Details, layout, arrangement, equipment requirements, and method of construction of the proposed excavation support system.

6. Procedures for resolving difficulties arising from misalignment of members exposed during excavation, and criteria for implementing those procedures.
 7. A plan of deformation monitoring points to monitor the performance of the excavation support system. The plan shall include a plan and elevation showing the monitoring point locations and frequency of monitoring. The Contractor's surveyor shall survey the elevation/location of each monitoring point in accordance with the approved plan. Submit excavation monitoring data of horizontal and vertical deflections of the support system within 24 hours of each survey along with all previous survey data.
- A. Design calculations shall include:
1. Loads on the excavation support system for all stages of excavation, bracing removal, and backfilling, including material, and equipment loads on adjacent ground during construction.
 2. Design of wall and all bracing members including all details for all stages of construction.
 3. Theoretical deflections of excavation support system and deformation of structures, pipelines, and other improvements located within the area of influence of the excavation.
- B. Submit to the Owner's Representative, a plan of action to be implemented in the event any deformation exceeds the calculated theoretical deflections. The plan of actions shall be positive measures by the Contractor to limit further movement of the wall including but not limited to trenching for struts and wales, placement of granular earth berms against the wall, installation of additional struts, or combinations thereof. The details of the mitigating measures shall include a schedule of implementation, location and/or availability of materials, structural details for all connections to the wall and support elements, and a detailed description of the method of implementation. The Contractor shall be prepared to work twenty-four hours per day to implement such measures. The remedial work/mitigating measures shall be at no additional cost to the Owner.
- C. Submit quality control measures as required to ensure that the performance of the excavation support system is consistent with the approved shop drawings and the requirements herein.
1. Submit the Contractor's qualifications as described herein.
 2. Submit Contractor's Design Engineer qualifications as described in herein.
 3. Submit welder qualifications and weld procedures in accordance with AWS D1.1.

4. At least one copy of the design shall be maintained at the job site during excavation that includes a plan indicating the sizes, types, and configurations of the materials to be used in the protective system, and the identity of the registered engineer who approved the design.
- D. Do not proceed with any support of excavation or protection activities until the submittal has been approved by the Owner's Representative.
- E. Contractor's Design Engineer's documentation shall include:
1. On-site inspections of excavation support system as the systems are constructed.
 2. Review of quality control measures and performance data.
 3. Certification that the excavation support system is constructed per the applicable design following completion of each support system and following any modifications by Contractor during construction.

1.04 QUALITY ASSURANCE

- A. A Preinstallation Conference shall be conducted between the Contractor and Owner's Representative prior to installation of the temporary excavation support.

1.05 PROJECT CONDITIONS

- A. The design of temporary excavation support systems is the responsibility of the Contractor. The design calculations and drawings shall be prepared, stamped and signed by a Professional Engineer registered in the State of New York, who is experienced in designing similar excavation support systems.
- B. All underground utility lines shall be identified, located, and protected from damage or displacement. Utility companies and other responsible authorities shall be contacted to locate and mark the locations and, if they so desire, direct or assist with protecting the underground installation. When required, the Contractor shall obtain an excavation permit from the local authority having jurisdiction prior to the initiation of any excavation work.
- C. Design shall consider all phases of construction. Design each member or support element to support the maximum loads that can occur during construction with appropriate factors of safety.
- D. The design shall consider conditions that may occur during the various stages of construction including, but not limited to; temporary or permanent alteration of the soils' in situ properties caused by the selected methods of construction, installation, relocation and removal of temporary bracing, excavation below bracing, dewatering of excavation, time related effects, shrinkage of concrete and load transfer to permanent structure.

- E. Design the support system to minimize horizontal and vertical movements and to protect adjacent structures and utilities from damage.
- F. Design, install, operate, and maintain ground water control system for excavations to control ground water inflows, prevent piping or loss of ground, and maintain stability of the excavation in accordance with Section 02140.
- G. The design of the temporary excavation support system shall be coordinated with the dewatering system and the cofferdam and water diversion system.
- H. Provide temporary security fencing around all excavations. Provide pedestrian and traffic control around working areas, support systems, excavations located within or adjacent to streets, park, roadways, freeways, driveways, or parking lots.
- I. Excavations below the level of the base of any adjacent foundation or retaining wall shall not be permitted unless the design of the excavation and bracing includes an analysis of the stability of the structure supported by the foundation and as necessary, incorporates required bracing/underpinning of the foundation.
- J. Prior to the start of work, engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
- K. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify the Owner's Representative if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide materials that are either new or in serviceable condition. All materials shall be sound and free from defects that may impair their strength.
- B. Concrete shall conform to ASTM C33 and ASTM C150 unless otherwise approved.
- C. Soldier piles and structural steel members shall conform to ASTM A572 or ASTM A242 unless approved otherwise. All structural steel shall be Grade 50 (50 ksi) or better. No members with permanent deformations are to be provided. Members shall not be spliced unless approved by the Owner's Representative.
- D. Wood used for vertical sheeting and shoring shall be of 3-inch minimum thickness, and shall be fir, spruce, pine, or hemlock, Grade 1 or 2, rough or planed surface, square edges or tongue and groove.

- E. Timber lagging shall be at least 3 inches thick.
- F. Horizontal wales and braces made of wood shall be of 6-inch minimum dimension. Members shall be securely anchored to prevent slippage.
- G. All timber shall be structural grade with a minimum allowable flexural strength of 1,100 psi.
- H. Wood shims for braces and wales shall not be permitted. Steel shims shall be used when required.
- I. Steel sheet piling shall conform to ASTM A328 or ASTM A572 unless approved otherwise. All steel sheet piling shall be Grade 50 (50 ksi) or better. All steel sheet piles shall be furnished with standard pulling holes located approximately 4 inches below the top of the pile, unless specified otherwise.
- J. Pipe piles used as soldier piles shall conform to ASTM A252, Grade 3 (45 ksi), or better unless approved otherwise.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install excavation support systems in accordance with the approved shop drawings and applicable permits.
- B. If settlement or deflections of supports indicate that support system requires modification to prevent excessive movements, redesign and resubmit revised shop drawings and calculations to the Owner's Representative at no additional cost to the Owner.
- C. Sufficient quantity of material shall be maintained on site for protection of work and for use in case of accident or emergency.
- D. Excavations shall be kept free of water at all times and a stable subgrade shall be maintained. Excavations shall be dewatered in accordance the project specifications.

3.02 INSTALLATION

- A. Soldier Piles:
 - 1. Steel soldier piles shall be installed prior to excavation
 - 2. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement.
 - 3. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging.

4. Accurately align exposed faces of flanges to vary not more than 1 inch from a horizontal line and not more than 1:120 out of vertical alignment.
5. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
6. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

A. Sheet Piling:

1. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier.
2. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer.
3. Limit vertical offset of adjacent sheet piling to 60 inches. Align exposed faces of sheet piling to vary not more than 1 inch from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

A. Bracing:

1. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
2. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by the Owner's Representative.
3. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
4. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.02 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

- B. Support members that are not removed shall be cut off at least 5 feet below finished grade or a depth approved by the Owner's Representative and abandoned in place.
- C. All voids created by the removal of the support system shall be immediately filled with lean concrete or sand by ramming with tools especially adapted to that purpose or otherwise as directed. The support system removed from the excavation shall remain the property of the Contractor and shall be removed from the site.
- D. No payment will be given for support members which has been left in the excavation for the convenience of the Contractor.

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END OF SECTION

SECTION 02262

SLURRY TRENCH

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all plant, labor, equipment, and materials and perform all operations as required to construct a Slurry Trench Cutoff wall at location and to the limits specified on the Drawings.

1.02 REFERENCE STANDARDS

- A. American Petroleum Institute (API)
 - 1. API Spec 13A – Specification for Oil-Well Drilling-Fluid Materials
 - 2. API RP 13B-1 – API Recommended Practice Standard Procedure for Field Testing Water-Based Drilling Fluids
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - 2. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - 3. ASTM C150 – Standard Specification for Portland Cement.
 - 4. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
 - 5. ASTM D1633 – Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders.
 - 6. ASTM D1140 – Standard Test Methods for Determining the Amount of Material Finer than 75- μ m (No. 200) Sieve in Soils by Washing.
 - 7. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - 8. ASTM D4380 – Standard Test Method for Density of Bentonitic Slurries.
 - 9. ASTM D4381 – Standard Test Method for Sand Content by Volume of Bentonitic Slurries.

10. ASTM D4832 – Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
11. ASTM D5084 – Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, the following:
 1. A detailed Work Plan describing proposed equipment, procedures, and schedules. The Work Plan shall include, at a minimum,
 - a. Plan for coordination of construction, maintenance and removal of working platforms, and mixing pads.
 - b. Proposed equipment including maximum depth capability of the excavator, number and type of backfill mixing equipment and specifications of slurry mixing equipment.
 - c. Procedures for water-bentonite slurry mixing, transportation and use.
 - d. Procedures for water-cement slurry mixing, transportation and use.
 - e. Procedures for soil-cement-bentonite slurry mixing, transportation and use.
 - f. Procedure for trench excavation and backfilling.
 - g. Material properties, sources, and manufacturer's certificates of quality.
 - h. Plan for control of drainage, spills, spoils, wastes, and spoils disposal and slurry disposal.
 2. A Quality Control Plan shall be submitted to include testing methods, frequencies, and minimum acceptable values. The plan shall explain the methods and locations for obtaining samples for testing and reporting schedules. Copies of quality control forms shall be submitted for review and approval.
 3. The proposed Design Mix shall be submitted, for the Owner's Representative's review and approval, prior to the start of the slurry wall construction.
 - a. A sampling plan including a description of the methods and locations of all samples used in the design mix testing shall be submitted prior to collection of any soil or rock samples at the site. Mixing water,

bentonite, clay, and borrow soils (if needed) should also be obtained and tested.

- b. Submit laboratory soil-cement-bentonite design mix and trial mix reports, including proportions, density, bentonite content, cement content, unconfined compressive strength, moisture content, gradations, Atterberg limits, and hydraulic conductivity on at least four samples of the proposed design mix.
 - c. Submit the source and properties of all materials including, but not limited to, water, bentonite, cement, on site soils, and any admixtures.
4. Reports shall be submitted to the Owner's Representative on a regular schedule during the course of construction of the slurry wall.
- a. Daily reports shall be submitted at the end of each work day. Laboratory test results shall be submitted within 2 days of receipt of the report from the laboratory. Final reports shall be submitted within 2 weeks of the completion of the work.
 - b. A record of soundings taken during construction including the depth of the trench, key, and backfill slope at the start and end of each work day. The soundings shall be used to generate an as-built profile of the trench, as constructed.
 - c. A record of plant-mixed bentonite slurry quantities, proportions, properties, and admixtures made during construction shall be submitted daily. Adjustments to the slurry mixture shall be noted.
 - d. A record of in-trench bentonite slurry properties made during construction shall be submitted daily. Procedures and admixtures used to modify slurry properties shall be noted.
 - e. If the cement addition is in the form of slurry, the slurry proportions and mixing procedures shall be recorded. If cement is added in another form the cement proportions shall be recorded.
 - f. A record of soil-cement-bentonite backfill material quantities, properties, and mix adjustments made during construction. Locations of each sample and number of molded specimens for laboratory testing shall be noted.
 - g. A record of quality control samples, tests and test results shall be submitted to the Owner's Representative.

1.04 QUALITY ASSURANCE

- A. The Contractor shall have at least 5 years of experience with work compatible to

the Work shown and specified, employing labor and supervisory personnel who are similarly experienced in this type of Work. An experienced installer that has specialized in design and construction of soil-cement-bentonite slurry walls.

- B. Construction is not permitted if air temperature is below 20 degrees Fahrenheit or when sever weather conditions may compromise the quality of the work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bentonite slurry shall consist of a stable, colloidal suspension of bentonite in water and shall be controlled in accordance with API standards (API RB 13B-1).
 - 1. At the time of introduction of the slurry into the trench, the slurry shall be a mixture of no less than 5% bentonite in water. Additional bentonite or admixtures may be required depending on the hardness and temperature of the water and the quality of bentonite. The slurry shall have a minimum apparent viscosity of 40 seconds reading through a Marsh Funnel Viscometer, a pH between 6 and 10 units, a minimum density of 64 pcf, and a filtrate loss of 25 cubic centimeters in 30 minutes at 100 psi.
 - 2. The slurry mixture in the trench shall have a unit weight not less than 64 pcf and not greater than 15 pcf less than the backfill unit weight unless approved, in writing, by the Owner's Representative.
- B. Bentonite used in preparing the slurry shall be pulverized premium grade sodium-cation montmorillonite and shall meet the most current API Std 13A. The yield of the bentonite shall be 90 barrels per ton.
- C. Cement shall be Portland Type II. Cement additives shall be approved by the Owner's Representative prior to use in the slurry mix.
- D. Water shall be potable, fresh water, free of excessive amounts of deleterious substances that adversely affect the properties of the slurry. It is the responsibility of the Contractor that the slurry resulting from the water shall always meet the standards of this specification.
- E. Admixtures of the type used in the control of oil-field or concrete slurries such as softening agents, dispersants, and retarder, plugging or bridging agents may be added to the water or slurries to permit efficient use of materials and proper workability. Any admixtures shall be approved by the Owner's Representative prior to use in the slurry mix.
- F. The material for trench backfilling shall be composed of fresh slurry, trench slurry, cement and selected soils obtained from a designated borrow area and/or trench spoils. Trench slurry may be disallowed if additives are not acceptable to the Owner's Representative. The soil shall be friable and free from roots, organic

matter, refuse, or other deleterious materials. The backfill shall be thoroughly mixed and reasonably well graded between the following gradation limits:

| Screen Size (US Standard) | Percent Passing (by Dry Weight) |
|---------------------------|---------------------------------|
| 3" | 100% |
| #200 | >20% |

The permeability of the backfill shall be less than 1×10^{-6} cm/sec. The slump of the backfill shall be 5 to 8 inches, and the density of the backfill shall be at least 15 pcf greater than the density of the slurry.

PART 3 - EXECUTION

3.01 GENERAL

- A. A slurry trench cutoff wall shall be constructed to the lines, grades, and cross sections indicated on the drawings. The trench shall have essentially vertical walls, a minimum width of 36 inches, and shall extend through the overburden to a minimum Elevation 1446 feet (NAVD88) as shown on the Drawings. A generalized description of the soil profile through which the slurry trench cutoff is to be constructed is provided on the boring logs attached to this specification.

3.02 TOLERANCES

- A. The walls of the slurry trench shall be essentially vertical.
- B. The depth of the slurry trench shall be measured or surveyed to within 4 inches of the desired elevation as specified on the drawings.
- C. The slurry trench alignment shall be measured or surveyed to within 6 inches of the alignment shown on the Drawings.

3.03 EQUIPMENT

- A. Excavation of the slurry trench cutoff wall shall be accomplished by use of any suitable earthmoving equipment, or combination thereof, such as a backhoe, clamshell, chisels, and ripper teeth so the trench can be carried to its final depth of cut continuously along the trench alignment. The excavator shall have the capability to excavate at least 10 feet deeper than the maximum depth shown on the plans. Special chopping, chiseling or other suitable equipment may be used as necessary to satisfactorily accomplish the required excavation. The width of the excavating tool shall be equal to or greater than the specified minimum width of the slurry trench. Additional equipment such as airlift pumps and slurry desanders shall be used, if required, to clean the trench bottom slurry in accordance with the requirements of the specification. The trench excavation equipment shall be capable of excavating the required key into the designated stratum
- B. The slurry batching plant shall include the necessary equipment including a high

shear mixer capable of producing a colloidal suspension of bentonite and/or cement in water, pumps, valves, hoses, supply lines, and all other equipment as required to adequately supply slurry to the trench and/or the backfill mixing operation. Storage ponds or tanks shall be provided as needed to store initially mixed slurry to allow hydration, and to retain a reserve in case substantial slurry loss through underlying previous zones occurs. All slurry held in storage shall be agitated or recirculated to maintain a homogeneous mix. All slurry for use in the trench or backfill shall be prepared using a suitable mixer. No slurry is to be made in the trench. Mixing of water and bentonite and/or cement shall continue until all particles are fully hydrated and the resulting slurry is homogeneous.

- C. Equipment for mixing and placing backfill may consist of any suitable earthmoving or grading equipment, such as bulldozers, or blade graders or backhoes, or blenders such as a pug mill, that are capable of thoroughly mixing the backfill materials into a homogeneous blend having the required gradation and properties and placing the material in the trench as specified.
- D. Soil clods shall be broken to 4-inch maximum diameter in the largest dimension by the backfill preparation equipment and methods employed. Deleterious materials and debris, oversize particles, shall be removed from the backfill before approval for placement.

3.04 SLURRY TRENCHING

- A. Excavation shall proceed continuously from the starting point to the finishing point as shown on the Drawings.
- B. Slurry shall be introduced into the trench at the beginning of trenching and shall be maintained in the trench until backfilling is complete. The level of the bentonite slurry shall always be maintained at least 3 feet above groundwater level and shall not be permitted to drop more than 2 feet below the surface of the working platform.
- C. The Contractor shall maintain the stability of the excavated trench at all times.
- D. The Contractor shall have personnel, equipment, and prepared slurry ready to raise the slurry level at any time. The Contractor shall have personnel on call as necessary to check the trench levels and to raise the slurry level weekends and/or holidays included.
- E. The final depth of the slurry trench shall be measured and checked by the Contractor for the Owner's Representative's approval prior to backfilling.
- F. If excavation to the depth specified on the Drawings, is not possible due to unforeseen conditions in the subsurface soils notify the Owner's Representative. The Owner's Representative may approve a new depth of wall or may require the slurry wall alignment to shift. Deviations to depth or alignment of the slurry wall outside of the tolerances specified herein shall not be made without permission, in

writing, by the Owner's Representative.

- G. The bottom of the trench shall be measured at points no greater than 25 feet apart at the beginning at the end of each day to monitor for cave-ins or excess settlement until the backfilling is complete. Readings shall be included in the daily report and sent to the Owner's Representative.
- H. Upon completion of excavation, all loose material or cuttings shall be removed from the bottom of the trench. The trench bottom shall be cleaned of debris and excess sand sediment backfilling.
- I. If the unit weight of the slurry in the trench exceeds the specified limits, or becomes unworkable, the heavy slurry shall be removed from the trench by airlift pump, clamshell, or other methods approved by the Owner's Representative or the excess solids shall be removed from the slurry by settling ponds, screening, or desanding.

3.05 BACKFILL MIXING

- A. Borrow materials and bentonite may be pre-mixed by blending in mechanical blenders or by windrowing, disk harrowing, bulldozing, blading or by other approved methods. Mixing and blending shall be performed in such a manner as to produce the required gradation of backfill. The backfill material shall be thoroughly mixed into a homogeneous mass, free of large soil clods, lumps or pockets of fines, sand, or gravel.
- B. The Contractor shall be responsible for the quality of the backfill.
- C. If the backfill is mixed beside the trench, the Contractor shall control and provide sufficient equipment and work platform space to support slurry spills, trench stability and mixing equipment operation.
- D. Unmixed material shall not be allowed to enter the trench.
- E. Cement, bentonite, and soils shall be mixed until homogeneous, tested for acceptability, and then immediately placed in the trench before it can harden or set. The soil-concrete-bentonite slurry shall be mixed in discrete batches not to exceed 50 cubic yards by mixing the ingredients together in lined pits, bermed areas, steel boxes, pugmills, or other suitable container. Soil-concrete-bentonite slurry shall not be mixed in uncontrolled proportions on the ground. Cement may be premixed with water to form a slurry for mixing with the other ingredients.
- F. The soil-concrete-bentonite slurry shall be sluiced with bentonite slurry from the trench or fresh bentonite slurry during blending operations. Sluicing with water will not be permitted. Just prior to placing, the backfill material shall have a slump of 5 to 8 inches. To this end, the materials shall be sampled and tested for permeability, unconfined compressive strength, density, and slump after preparation.

3.06 PLACEMENT OF BACKFILL

- A. The backfill shall be placed continuously from the beginning of the trench, in the direction of the excavation, to the end of the trench. The toe of the slope of the trench excavation shall precede the toe of the backfill slope so that the toe of the backfill shall not be closer than 20 feet to the toe of the excavation slope, or as required to permit proper cleaning of the trench bottom as approved by the Owner's Representative.
- B. Excavation shall not exceed 50 feet from the toe of the backfill.
- C. Excavation must permit inspection and measurement immediately after completion and prior to backfilling.
- D. Placing operations shall proceed in such fashion that the surface of the backfill below the slurry shall follow a reasonably smooth grade and shall not have hollows, which may trap pockets of slurry during subsequent backfilling. Free dropping of backfill material through the slurry will not be permitted.
- E. Initial backfill shall be placed by lowering it to the bottom with clamshell bucket or backhoe until the surface of the backfill rises above the surface of the slurry or by lead-in slope. Additional backfill may then be placed in such manner that the backfill enters the trench by sliding down the forward face of the previously placed backfill. To accomplish this, sufficient backfill shall be piled behind the crest of the existing backfill slope to cause a mud wave action at the face of the backfill. The backfill shall not be dropped or deposited in any manner that will cause segregation of materials.
- F. The Contractor shall be prepared to remove, displace, or treat cement-bentonite gel that forms in the trench, if it interferes with backfill placement. Toward this end the Contractor shall be prepared to probe through any gel to properly record the depth of the trench.
- G. The surface of the backfill shall not be allowed to desiccate prior to placing the final cap. A temporary covering may be used to protect the backfill prior to placing the final cap. Temporary crossings of compacted soil or trench plates shall be used for heavy equipment crossings. The temporary covering shall consist of at least 1 foot of uncompacted backfill placed within 1 day after the backfill is placed. After a minimum of one week, the temporary cover may be removed. Any depressions or settlement shall be repaired by placing additional backfill or the permanent cap.
- H. Upon completion of backfill placement and before desiccation of the backfill surface can occur, the cutoff trench shall be covered in accordance with the final cap details shown on the Drawings.

3.07 CLEANUP

- A. After completion of the backfill and capping, all remaining excavated material and slurry shall be removed and the surface shall be cleaned and leveled as directed by the Owner's Representative. Excess slurry shall be disposed by drying, mixing with dry materials or spreading in thin layers on adjacent areas designated by the Owner's Representative.
- B. No slurry shall be left in ponds, and all ponds shall be pumped dry and backfilled in a controlled manner.

3.08 QUALITY ASSURANCE

- A. Perform the following tests to the standards and frequency specified below:

| Property | Test Method | Min Test Frequency | Requirement |
|-----------------------------------------------------------------------|-----------------------------------|--------------------|----------------------------------------------------------|
| <i>Bentonite Powder</i> | | | |
| Yield Point/Plastic Viscosity (YP/PV) | API Spec 13A | 1 per truckload | > 3 |
| Viscometer at 600 rpm | API Spec 13A | 1 per truckload | > 30 |
| Filtrate Loss | API Spec 13A | 1 per truckload | < 15 cc |
| Moisture Content | API Spec 13A | 1 per truckload | < 10% |
| Residue > 75 micrometers | API Spec 13A | 1 per truckload | < 4% |
| <i>Water for Slurry Mixing</i> | | | |
| pH | SPI RP 13B-1 | 1 per source | 6 to 8 |
| Hardness | SPI RP 13B-1 | 1 per source | < 100 ppm |
| Total Dissolved Solids | EPA 600 | 1 per source | < 500 ppm |
| <i>Initial Bentonite Slurry (prior to introduction to the trench)</i> | | | |
| Viscosity | ASTM D6910 | 2 per shift | > 36 seconds |
| Density | ASTM D4380 | 2 per shift | ≥ 64 pcf |
| Filtrate Loss | API RP 13B-1 | 2 per shift | < 30 cc |
| Bentonite Content | Weight-Volume | 1 per project | ≥ 4% |
| <i>In-Trench Bentonite Slurry</i> | | | |
| Viscosity | ASTM D6910 | 2 per shift | > 36 seconds |
| Unit Weight | ASTM D4380 | 2 per shift | > 64 pcf and < 15 pcf less than Initial Bentonite Slurry |
| <i>Soil Cement Bentonite Slurry</i> | | | |
| Slump Cone | ASTM D143 | 2 per shift | 3 to 8 inches |
| Gradation | ASTM D1140 | 1 per 100 cy | 15% < #200 sieve < 85% |
| Density | ASTM C138 or ASTM 4380 (modified) | 2 per shift | 15 pcf > in-trench slurry |
| Permeability | ASTM D5084 | 1 per 100 cy | Less than 10 ⁻⁶ cm/sec |
| UCS | ASTM D2166 | 1 per 100 cy | Greater than 30 psi |

- B. Measurements of the bottom of the trench and trench alignment shall be taken every 20 feet along the trench centerline using a weighted tape, cable, or other device. Measurements shall be recorded to the nearest 0.25 inch and shall record the following:
1. Top of the sand stratum: The top elevation of the sand stratum shall be estimated based upon an examination of cuttings and the level of effort of excavation.
 2. Bottom of Excavation: The elevation of the trench shall be determined subject to approval by the Owner's Representative. Prior to backfilling, measurements shall be taken to monitor for sidewall collapse and accumulation of sediments.
 3. Profile of the backfilled slope: The soil-cement-bentonite backfill slope and trench bottom shall be measured at the beginning and end of each day and shown on an as-built drawing. The drawing shall be reviewed daily as an indication of any trench collapse, excessive settlement or sloughing.
- C. The field laboratory shall, at a minimum, include the following:
1. Marsh funnel and cup;
 2. Mud balance;
 3. pH tape;
 4. Standard Filter Press with graduate cylinder; and
 5. Slump cone and rod.
- D. A qualified off-site laboratory shall be engaged to perform the following tests. Samples shall be delivered to the laboratory on an expedited schedule and test results shall be reported the same week as samples are received.
1. Permeability of soil-cement-bentonite slurry backfill in accordance with ASTM D5084.
 2. Grainsize of soil-cement-bentonite slurry backfill in accordance with ASTM D2488.
- E. Flexible wall permeability tests shall be conducted in accordance with ASTM D5084 on samples of the backfill to determine compliance with these specifications. Samples of the backfill shall be obtained from the mixing area and sent to the off-site laboratory for testing. The test parameters shall be as follows:
1. Average Effective Confining Stress = 15 psi
 2. Hydraulic Gradient = 10

- F. Results of all tests performed shall be recorded on forms acceptable to the Owner's Representative and signed by the Contractor. These forms will be available to the Owner's Representative at all times for his inspection. Copies of all quality control documents will be submitted daily to the Owner's Representative for their review.

- G. An as-built profile drawing of the trench bottom and backfill slope shall be continuously maintained by the Contractor. The profile shall indicate the extent of excavation and backfill at the end of each working day.

* * * * *

END OF SECTION

SECTION 02270

TEMPORARY EROSION AND SEDIMENT CONTROLS

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This work shall consist of control measures required by the specifications or as ordered by the Owner's Representative during the life of the Contract to control erosion, water pollution, and water runoff through the use of dikes, gravel, mulches, silt fences, check dams, hay bales, sedimentation basins, and other control devices or methods. All drain trenches, water channels, outlets, and catch basins shall be protected and maintained free flowing and free of debris. All roadways shall be maintained free of debris.
- B. Contractor shall provide adequate erosion and sedimentation control as shown on the Drawings and where necessary including but not limited to storage/staging areas, dam abutments, steep slope areas, and cofferdams.
- C. Contractor shall be responsible to evaluate the erosion potential for all construction operations, taking into account seasonal climate, soil characteristics, topography, and recommendations for ground cover materials to ensure a stabilized surface throughout the construction period.
- D. At the conclusion of the work the Contractor shall remove erosion and sediment controls once the site has been fully stabilized against erosion. All silt and waste materials shall be disposed of in proper manner.
- E. In the event of conflict between these specification requirements and pollution control laws, rules or regulations of other Federal, State or local agencies, the more restrictive laws, rules or regulations shall apply.

1.02 SUBMITTALS

- A. Submit to the Owner's Representative, in accordance with Section 01300, product data for all commercial products for erosion and sedimentation control. Product data shall be submitted including manufacturer's technical data and installation instructions for, at a minimum, the following:
 - 1. Silt Fence
 - 2. Geotextile Materials
 - 3. Stone Materials
 - 4. Jute Mesh
 - 5. Temporary and Permanent Seeding
- B. Submit to the Owner's Representative a schedule and program for erosion and sedimentation control measures to include the proposed schedule and proposed

control measures to be implemented for erosion and sedimentation control at the site.

1.03 REFERENCES

- A. New York State Standards and Specifications for Erosion and Sediment Control (Blue Book).

1.04 EROSION AND SEDIMENT CONTROL

- A. The Contractor shall provide all labor, equipment and materials necessary to construct temporary and/or permanent control measures to control erosion and limit sediment discharges to storm drains, streams, rivers, lakes, canals, or any other body of water from construction operation. Such measures shall include the construction of temporary berms, diversion ditches, dike checks, sediment structures (traps, basin(s), embankments), silt fence, and the use of mulches, seeding or other control measures as noted on the drawings.
- B. The Contractor shall comply with all applicable Federal, State and Local regulations and laws. In the event of a discharge to streams, rivers, lakes or canals that causes a visible plume in the receiving water body, the Contractor shall immediately notify the Owner's Representative.
- C. Erosion control features shall be installed by the Contractor as required to comply with the New York State Guidelines for Soil Erosion and Sediment Control.
- D. The Contractor shall make every effort to minimize erosion from clearing and grubbing, excavation and backfilling operations, including, but not limited to, the following:
 - 1. Construction of temporary berms, dikes, and diversion ditches to divert runoff of rainwater in an approved manner, at the conclusion of each day's activities. Runoff, as defined in this specification, is that portion of the precipitation on a drainage area resulting from the 10-year, 24-hour rainfall event, which is discharged from that area via surface drainage.
 - 2. Use of extreme caution to limit disturbances of natural areas to the absolute minimum required.
 - 3. Sequencing of clearing and grubbing, excavation and backfilling operations to maintain natural traps for eroded material and any other measures effective in minimizing erosion and limiting sediment discharge.
 - 4. Excavation from any source shall not be deposited in or near rivers, streams, or impoundments nor otherwise located to be susceptible to erosion due to high water, flooding, or rainwater runoff except as allowed in applicable permit conditions.
 - 5. Shaping of the top of earthwork in a manner to permit and facilitate the runoff of rainwater. Drainage ditches and/or interceptor dikes shall be provided along the top of all excavated slopes and along the inside edge of all berms. The protective measures at the top of slopes shall be constructed before excavation.

- E. Structural Practices: Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include the following devices. Location and details of installation and construction are shown on the drawings.
1. Silt Fence
 - a. The Contractor shall provide silt fence as a temporary structural practice to minimize erosion and sediment runoff. Silt fence shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Silt fence shall be installed in the locations indicated on the drawings and as approved. Final removal of silt fence barriers shall be upon approval by the Owner's Representative's Representative.
- F. All erosion and sediment control measures must be constructed prior to beginning any land disturbances. These measures and devices cannot be removed until the disturbed areas are stabilized and stabilization has been approved by the Owner's representative. All devices must be properly maintained and kept in operating condition for the duration of construction.
- G. Runoff from any land disturbing activity shall not be directly discharged or have the potential to be discharged off site, onto roadways, or into storm drains or into a watercourse. Accumulated sediment in a properly designed silt fence, check dam or other sediment trap shall be removed when 60% of the storage capacity of the structure is filled with sediment.
- H. All sites shall be seeded and stabilized with erosion control measures, such as straw mulch, jute mesh, or excelsior within five (5) days of final grading. If construction is suspended, or sections completed, areas shall be seeded immediately and stabilized with appropriate erosion control measures. Maintenance shall be performed as necessary to ensure continued stabilization.
- I. Temporary sediment trapping devices, such as silt fences, shall be removed within thirty (30) calendar days following establishment of permanent stabilization.
- J. All points of construction ingress and egress shall be protected to prevent the deposition of materials onto roadways and paved areas either by installing and maintaining a stabilized construction entrance, or by washing all vehicle wheels in a safe disposal area. All materials deposited onto roadways and paved areas shall be removed immediately.
- K. Areas that are completed either before or after the seeding season specified, and all areas that will be left exposed for more than five (5) days, including all excavated and stockpiled materials, shall be temporarily mulched with hay (straw) and

anchored with Terratac or other approved binder. The application rate for temporary mulching shall be two (2) tons of mulch per acre and application of mulch anchorage/binder at rates recommended by the manufacturer, unless otherwise noted.

- L. Seeding shall be in accordance with New York State Standards and Specifications for Erosion and Sediment Control, unless otherwise noted.

1.05 DUST AND FUME CONTROL

- A. The control of potentially harmful dusts, fumes, mists, gases, smoke, sprays, or vapor, shall be accomplished by accepted engineering control measures, for example, enclosure or confinement of the operation, ventilation, and substitution of less toxic materials.

PART 2 - PRODUCTS

2.01 SILT FENCE

- A. Filter Fabric

- 1. The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE

| PHYSICAL PROPERTY | TEST PROCEDURE | STRENGTH |
|--------------------------------|----------------|---------------------------|
| Grab Tensile Elongation (%) | ASTM D 1682 | 90 lbs. min. 50 % max. |
| Mullen Burst (PSI) | ASTM D 3786 | 190 lbs. min. |
| AOS (U.S. Std Sieve) | ASTM D 4751 | 40-80 |

- B. Silt Fence Stakes and Posts

- 1. The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 inches by 2 inches and shall have a minimum length of 4 feet. Steel posts shall be standard "U" or "T" section posts.

- C. Prefabricated Silt Fence Systems

1. Mirafi Envirofence or approved equal.

2.02 JUTE MATTING

- A. The jute matting shall be BioD-Mat 70, woven bristle coir erosion control matting by RoLanka International or approved equal. Blanket to be 100% biodegradable capable of receiving, supporting growth, and development of vegetation typical of this project. Staples used to stake matting shall be biodegradable and at least 8 inches long.

| Property | Test Method | BioD-Mat® 70 |
|----------------------------------|-------------|----------------------------|
| Weight | ASTM D 3776 | 23 oz/SY (780 g/sq.m) |
| Dry tensile strength | | 1740 lbs/ft (25.4 kN/m) |
| Machine direction | | 1176 lbs/ft (17.2 kN/m) |
| Cross direction | ASTM D 4595 | |
| Wet tensile strength | | 1488 lbs/ft (21.7 kN/m) |
| Machine direction | | 1032 lbs/ft (15.1 kN/m) |
| Cross direction | ASTM D 4595 | |
| Elongation at failure Wet | | |
| Machine direction | | 38% |
| Cross direction | ASTM D 4595 | 25% |
| Open area | Calculated | 48% |
| Thickness | ASTM D 1777 | 0.35 in (9 mm) |
| Minimum Twine Count | | |
| MD x CD (per foot) | | 27 x 18 |
| Recommended slope | | > 1:1 |
| Recommended flow | | 12 fps (3.7 m/s) |
| Recommended shear stress | | 4.5 lbs/sq.ft (215 N/sq.m) |

2.03 TURBIDITY CURTAIN

- A. The turbidity curtain shall be a pre-manufactured turbidity curtain consisting of an impervious membrane with an integral foam billet flotation system and a weight system to anchor the curtain to the river bottom and prevent movement of the curtain base. The curtain shall be capable of withstanding the wind and current conditions at the site without allowing the release of the contained sediment laden water. The curtain shall be 20% greater than the depth of the water to allow for water level fluctuations.
- B. Pre-fabricated turbidity curtains shall conform to NYSDOT specification 209-3.12.

PART 3 – EXECUTION

1.06 INSTALLATION OF SILT FENCE

- A. The silt fence shall be installed in accordance with the detail shown on the Drawings.

- B. Silt fence shall extend a minimum of 24 inches above the ground surface and shall not exceed 30 inches above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6 - inch overlap, and securely sealed. A trench shall be excavated approximately 6 inches wide and 6 inches deep on the upslope side of the location of the silt fence. The filter fabric shall extend into the trench and the 6-inch by 6-inch trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Owner's Representative.
- C. The Contractor shall provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Fences shall be properly placed to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in an area between a ridge and drain, fences shall be placed as work progresses, fences shall be removed/replaced/relocated as needed for work to progress in the drainage area). Areas where silt fences are to be used are shown on the drawings. Final removal of silt fence barriers shall be upon approval by the Owner's Representative. Unless otherwise directed or shown on the drawings, rows of silt fences shall be provided as follows:
 - 1. Along the downhill perimeter edge of all areas disturbed.
 - 2. Along the toe of all cut slopes and fill slopes of the construction areas.
 - 3. At the entrance to culverts that receive runoff from disturbed areas.

3.02 INSTALLATION OF JUTE MATTING

- A. The jute matting shall be installed along lake edges and stream banks to control erosion while vegetation is established where slopes are steeper than 3H:1V up to 1.5H:1V. Erosion control blanket is to be installed using staples spaced and installed per manufacturer's recommendations. Staples to be secured through blanket to full depth of staple.

3.03 INSTALLATION OF TURBIDITY CURTAIN

- A. The turbidity curtain shall be installed in locations as indicated on the drawings.
- B. All turbidity curtains shall extend the full depth of the pond and their depth adjusted as required to match any new bottom contours as the work progresses.
- C. The turbidity curtains shall be maintained in good operating conditions during the entire period of the work.

3.04 MAINTENANCE

- A. The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion

and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

1. **Silt Fence Maintenance:** Silt fence shall be inspected in accordance with paragraph 3.06 INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded and mulched in accordance with the requirements herein.
2. **Stabilized Construction Entrance Maintenance:** The stabilized construction entrances shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way or streets or into waterbodies. This may require periodic top dressing with additional aggregate or removal and replacement of existing aggregate. All sediment spilled, dropped or washed on to public rights-of-way or into waterbodies must be removed immediately.

3.05 When necessary, wheels must be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment trapping device. All sediment shall be prevented from entering storm drains, ditches, or watercourses.

3.06 INSPECTIONS

- A. The Contractor shall perform inspections of all erosion and sediment control practices in accordance with the following schedule until final stabilization is achieved.
 1. Daily inspections during all soil disturbing activities.
 2. Weekly inspections when soil disturbing activities have ceased until final stabilization.
- B. Disturbed areas and areas used for material storage, if applicable, that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system and/or receiving waters. Erosion and sediment control measures identified on the Contract Drawings shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the construction site, including adjacent roadways, shall be inspected for evidence of offsite sediment tracking. Specific inspection scheduling requirements mentioned in previous sections apply if they are stricter than this paragraph.

* * * * *

END OF SECTION

SECTION 02271

RIPRAP

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes furnishing, transporting, and the installation of rock riprap revetments and blankets, including filter or bedding where specified.

1.02 SUBMITTALS

- A. Submit in accordance with Section 01300 product data for each type of product indicated.
- B. Material Test Reports: For each riprap material proposed for use at the site.

1.03 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- B. Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article.

PART 2 - PRODUCTS

2.01 ROCK RIPRAP

- A. Rock riprap shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The rock shall be angular to sub-rounded in shape with the greatest dimension not greater than 2 times the least dimension. It shall be free from dirt, clay, sand, rock fines, and other material not meeting the required gradation limits. Rock density shall be 165 pounds per cubic foot or greater. Rock hardness shall be such that it will not dent when struck with the rounded end of a one pound ball peen hammer, or hardness shall be determined by other methods approved by the Owner's Representative. Unless otherwise specified on the plans riprap gradation shall conform with the gradations as follows:

| | |
|------|-----------|
| D50 | 18 inches |
| D100 | 25 inches |

- B. Before rock is delivered from its source, the contractor shall designate the source from which rock material will be obtained and provide information satisfactory to the Owner's Representative that the material meets design requirements. The contractor shall provide the Owner's representative free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified herein.

PART 3 - EXECUTION

3.01 RIPRAP PLACEMENT

- A. The rock shall be placed on the surfaces and to the depths specified in such a manner as to avoid displacement of underlying materials. The rock may be equipment or hand placed as necessary to produce a surface in which the tops of the individual rocks do not vary more than one quarter of the D50 (1/4 * D50) or specified deviation from the neat lines shown on the drawings.
- B. Riprap shall have a minimum placed thickness of 36 inches with individual pieces at the surface having a maximum deviation of plus or minus 2 inches.
- C. Rock shall also be placed in a manner to prevent damage to structures. Hand placing may be required to prevent damage to the permanent works. Double decking of thin, flat rocks to bring the surface up to the required grade will not be permitted.

* * * * *

END OF SECTION

SECTION 02272
GEOTEXTILES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to install non-woven geotextile for use as a filter separator between the subgrade and access road layer as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

- A. Submit to the Owner's Representative, in accordance with Section 01300, within 30 days prior to the start of the work of this Section:
1. Technical product literature for all commercial products to be used for geotextile.
 2. List of material properties, samples of geotextile with attached certified test results.
 3. Copy of quality control certificates in conformance with Paragraph 2.02.

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
1. ASTM D1777 - Standard Test Method for Measuring Thickness of Textile Materials.
 2. ASTM D5261 - Standard Test Method for Mass Per Unit Area (Weight) of Woven Fabric.
 3. ASTM D6241 - Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
 4. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 5. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 6. ASTM D4632 - Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
 7. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. The geotextile shall be shipped, stored and handled in accordance with manufacturer's recommendations and as specified herein.
- B. The fabric shall be stored with a cover so that it is protected from exposure to sunlight and shall be elevated from the ground (a minimum of 3 in) to protect the fabric from stones and other sharp objects.

1.05 REQUIREMENTS PRIOR TO INSTALLATION

- A. The subgrade shall be inspected and approved by the Owner's Representative prior to installation of the geotextile. The subgrade shall be smooth, uniform and compacted for the installation of the fabric.

1.06 MATERIAL WARRANTY

- A. The manufacturer shall warrant the material, against manufacturing defects and material degradation for a period of twenty years from the date of installation. The manufacturer shall replace any material which fails within the warranty period. The manufacturer shall furnish a written warranty covering the requirements of this Paragraph.

1.07 GUARANTEE

- A. The Contractor shall guarantee the geotextile against defects in installation and workmanship for the period of two years commencing with the date of Final Acceptance. The guarantee shall include the services of qualified service technicians and all materials required for the repairs at no expense to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration.

2.02 MATERIALS

- A. Non-woven Geotextile
 1. Non-woven geotextile shall be Mirafi 1100N, or approved equal.
 2. Non-woven geotextile shall be placed on the prepared subgrade for separation underlying the bedding below the riprap and articulated concrete block mat as shown on the Drawings.

3. The geotextile shall be nonbiodegradable, nonreactive within a pH range of 3 to 11, resistant to ultraviolet light exposure, and resistant to insects and rodents. Test results from any sampled roll in the lot, when tested in accordance with ASTM D4759, shall meet or exceed the values listed in Table 1.

TABLE 1

MINIMUM AVERAGE ROLL VALUES FOR NON-WOVEN GEOTEXTILE

| PROPERTIES | TEST METHOD | MINIMUM AVERAGE ROLL VALUES | |
|-----------------------|-------------|-----------------------------|-------|
| | | UNIT | VALUE |
| Grab Tensile Strength | ASTM D4632 | lbs | 250 |
| Grab Elongation | ASTM D4632 | % | 50 |
| CBR Puncture Strength | ASTM D6241 | lbs | 700 |
| Puncture Strength | ASTM D4833 | lbs | 115 |
| Permittivity | ASTM D4491 | sec ⁻¹ | 0.8 |
| Burst Strength | ASTM D3786 | psi | 400 |

2.03 QUALITY CONTROL DOCUMENTATION

- A. Prior to installation the Contractor shall provide to the Owner the following information certified by the manufacturer for the delivered fabric.
 1. Each roll delivered to the Project site shall have the following identification information:
 - a. Manufacturer's name
 - b. Product identification
 - c. Thickness
 - d. Roll number
 - e. Roll dimensions
 2. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency and test results. At a minimum the following test results shall be provided every 25,000 square feet of manufactured fabric in accordance with test requirements specified in Paragraph 2.02.
 - a. Thickness
 - b. Trapezoid Tear

c. Puncture Resistance

d. Grab Tensile

2.04 CONFORMANCE TESTING

- A. Conformance testing shall be performed by a Geosynthetics Research Institute (GRI) accredited independent Quality Assurance Laboratory (QAL) employed by the Contractor. Owner's Representative shall obtain samples from the delivered material, mark the machine direction and identification number. One sample shall be taken per 50,000 square feet, or one sample per lot, whichever results in the greater number of conformance tests. This sampling frequency may be increased as deemed necessary by the Owner's Representative. The samples shall be taken across the entire roll width and shall not include the first 3 ft. The following conformance tests shall be conducted at the laboratory.
1. Mass per unit area (ASTM D5261)
 2. CBR Puncture Strength (ASTM D6241)
 3. Trapezoid Tear Strength (ASTM D4533)
 4. Grab tensile (ASTM D4632)
 5. Permittivity (ASTM D4491)
 6. Apparent opening size (ASTM D4751)
- B. These conformance tests shall be performed in accordance with test requirements Paragraph 2.02.
- C. All conformance test results shall be reviewed by the Owner's Representative and accepted, prior to the deployment of the fabric. All test results shall meet, or exceed, the property values listed in Paragraph 2.02.
- D. The manufacturer reserves the right to obtain additional samples from rolls immediately before and after the failing roll or as directed by the Owner's Representative and request testing by the QAL at the manufacturer's expense. If these rolls pass, then only the failing roll will be rejected. If they fail, then the entire lot will be rejected.
- E. If the fabric fails the first-run unit conformance tests, the contractor shall pay for the cost of subsequent conformance testing until all conformance tests are passed and the fabric is accepted by the Owner's Representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Geotextile Placement

1. The geotextile shall be installed as shown on the Drawings and in accordance with the manufacturer's recommendations and approved shop drawings.
2. The subgrade shall be maintained in a smooth, uniform and compacted condition during installation of the geotextile beneath the erosion control stone.
3. Fill materials shall be installed in accordance with Section 02200.
4. Damage to the geotextile occurring during installation and the placement of material shall be repaired immediately at no additional expense to the Owner.
5. All geotextile installation shall be completely covered at the end of each work day unless otherwise approved by the Owner's Representative.

B. The geotextile shall be overlapped a minimum of 24 inches.

3.02 FIELD QUALITY CONTROL

- A. Two duplicate documentation files for geotextile placement shall be maintained. One shall be maintained by the Contractor and the other by the Owner's Representative. At the end of each work week the files shall be updated and checked to assure that all copies of pertinent project information are included in each file. The Contractor shall submit daily copies of the documentation to the Owner's Representative.
- B. The geotextile installation and related work shall be inspected by the Owner's Representative. All work in the system therein being inspected shall be complete, clean and ready for use. All work shall meet the requirements of cleanliness and workmanship, as determined by the Owner's Representative.
- C. Discrepancies shall be noted and repaired at no additional expense. Final acceptance of the system shall be contingent upon the approval of the Owner's Representative.

* * * * *

END OF SECTION

SECTION 02930

TOPSOIL AND TURF ESTABLISHMENT

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Work covered by this section shall include furnishing, placing, grading and treating topsoil, seeding, and maintaining seed bed until establishment of an acceptable stand of grass.

1.02 SUBMITTALS

- A. Submit, in accordance with Section 01300, the following for approval prior to delivery to the site.
 - 1. Supplier's Certificate of Compliance attesting that the following materials meet the requirements specified:
 - a. Seed
 - b. Lime
 - c. Fertilizer

PART 2 – PRODUCTS

2.01 TOPSOIL

- A. Suitable topsoil material stripped from the site and stockpiled separately from other excavated material or imported material.
- B. Imported Topsoil shall conform to "Loam, Sandy Loam, Silt Loam" as shown on the USDA Soil Survey Staff Textural Triangle (1962,1975). Material shall meet the following requirements:
 - 1. Sixty (60) percent to seventy-five (75) percent, by weight, mix of medium and fine sand as defined in ASTM D2487.
 - 2. Twenty-five (25) percent to forty (40) percent, by weight, mix of clay and silt as defined in ASTM D2487.
 - 3. Screened to remove all materials in excess of 1-inch greater dimension.
 - 4. pH range shall be 6.5 to 7.5.

5. Organic content shall be not less than 2 percent nor more than 10 percent by weight.

2.02 LIME

- A. Standard, ground dolomitic limestone, agricultural grade, containing a minimum of 88 percent of calcium and magnesium carbonates. One hundred percent shall pass the 10 mesh sieve, minimum 90 percent shall pass the 20 mesh sieve, and minimum 80 percent shall pass the 100 mesh sieve.

2.03 FERTILIZERS

- A. Standard quality commercial carriers of available plant food nutrients.
 1. Starter Fertilizer:
 - a. A complete fertilizer having a guaranteed minimum analysis of 10-10-10 (N-P-K) with 35 percent or more of total nitrogen in water insoluble.
 - b. Greenlawn Turf Starter (11-25-11) by Agway, Inc. or approved equal.
 2. Final Fertilizer:
 - a. A slow release nitrogen fertilizer, organic or ureaform, with a minimum analysis of 32-0-0 (N-P-K).
 - b. Greenlawn Fertilizer (32-3-5) by Agway, Inc. or approved equal.

2.04 SEED

- A. State certified seed of the latest season's crop.
- B. Deliver in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weed seed content, and inert material.
- C. Mix:

| <u>Name of Seed</u> | <u>Percent by Weight</u> |
|----------------------------------------------------------------|--------------------------|
| Kentucky Bluegrass, "Rugby" or "Flyking" (Poa pratensis) | 40 percent |
| Creeping Red Fescue, "Pennlawn" Or "Banner" (Festuca rubra) | 40 percent |
| Perennial Ryegrass, "Pennfine" (Lolium perenne) | 20 percent |

2.05 MULCH

- A. Straw mulch shall be unrotted, small grain straw or hay, free from weed seeds.
- B. Wood cellulose pulp fibre for use with hydraulic seeding operations: “Silva Fibre”, as produced by Weyerhaeuser Co., Tacoma, WA, or as approved.

2.06 WATER

- A. Where needed, water from the canal can be used, or Contractor can make other provisions for watering.

PART 3 – EXCUTION

3.01 SEEDBED PREPARATION

- A. Subgrade
 - 1. Clean subgrade surface of all stumps, stones, roots, trash, or other materials that might hinder proper tillage or spreading.
 - 2. Loosen subgrade by disking, scarifying, or harrowing to a depth of 2 inches to provide bonding of subsoil with topsoil.
- B. Topsoiling
 - 1. Place topsoil only when seeding operations can closely follow spreading operations.
 - 2. Spread topsoil evenly to such a depth that, after natural settlement and light rolling, the finished surface will conform to the lines, grades, and elevations shown on the drawings without unsightly variations, bumps, ridges, ruts or depressions.

3.02 REGULAR GRASS CONSTRUCTION, HYDRAULICALLY OR MECHANICALLY

- A. General
 - 1. Apply lime to in-place topsoil at the rate required to assure proper pH as determined by pH tests. Thoroughly incorporate lime into top 3 inches.
 - 2. Starter fertilizer shall be applied at the rate specified by the manufacturer.
 - 3. Spread seed evenly at a minimum rate of 10 pounds of pure live seed per 1000 square feet.
 - 4. Apply mulch evenly to a depth of approximately 1 inch over seeded area.
- B. Immediately after seeding the entire area shall be firmed with an approved lawn roller, weight not to exceed 90 pounds for each foot of roller width. If seeding is

performed with a cultipacker type seed, or if seed is applied in combination with hydro-mulching, rolling may be eliminated.

- C. Maintain a moist seedbed at all times. Water seedbed so that the topsoil is wet to a depth of 3 inches at the time of seeding. If necessary, supplement natural rainfall with sufficient water until acceptance.
- D. Protect the seedbed with barricades, as necessary, to keep all traffic off the area. Remove barricades upon final acceptance.

3.03 MAINTENANCE PERIOD, INSPECTION, AND ACCEPTANCE

A. Maintenance

- 1. Begin maintenance immediately after seeding and continue until acceptance.
- 2. Protect and maintain by watering, reseeding, mowing, weeding, rolling applying insect or disease control measures, refertilizing, and employing all other measures necessary to establish an acceptable stand of grass.
- 3. Mowing - new turf shall be mowed a minimum of 3 times. When average grass height reaches 3-1/2 inches, mow to the height 2-1/2 inches.
- 4. Final Fertilization - provide an application of a slow release nitrogen final fertilizer at a rate specified by the manufacturer.

B. Inspection and acceptance

- 1. No seeded areas will be accepted:
 - a. Prior to 60 days from the date of seeding.
 - b. Prior to the completion of 3 mowings.
- 2. The Owner's Representative will be the sole judge of acceptance.
- 3. Replacement - areas that do not have acceptable stand of grass shall be reseeded and maintained until an acceptable stand of grass is established.

END OF SECTION

SECTION 03151
PVC WATERSTOPS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide waterstops embedded in concrete and spanning control, expansion, and/or construction joints to create a continuous diaphragm to prevent fluid migration.

1.02 REFERENCES

- A. PVC WATERSTOP
 1. US Army Corps of Engineers: CRD-C 572-74
 2. American Society for Testing Materials (ASTM)
 3. US Bureau of Reclamation: C-902
 4. Canadian General Standards Board: 41-GP-35M Types 1 & 3

1.03 QUALITY ASSURANCE

- A. Waterstop manufacturer shall demonstrate five years (minimum) continuous, successful experience in production of waterstops.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store waterstops under tarps to protect from oil, dirt, and sunlight.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide flexible PVC (polyvinyl chloride) waterstop as indicated on the drawings manufactured by Greenstreak or approved, with the following applications:
 1. Construction joints between two new concrete pours:

Greenstreak Profile style number 732 with minimum width of 6" and thickness of 3/8"
 2. Construction joints between existing concrete abutments and new concrete pours:

Greenstreak Profile style number 609 complete system with minimum dimensions of 6” width, 3” height and 3/8” thickness, with stainless steel battens, 1/4” stainless steel anchors and epoxy.

- A. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.
- B. Performance Requirements as follows:

| Property | Test Method | Required Limits |
|----------------------------------------------------------------------|-------------|-----------------------------------------|
| Water absorption | ASTM D 570 | 0.15% max |
| Tear Resistance | ASTM D 624 | 300 lb/in (52.5 kN/m) min. |
| Ultimate Elongation | ASTM D 638 | 350% min. |
| Tensile Strength | ASTM D 638 | 2000 psi (13.78 Mpa) min. |
| Low Temperature Brittleness | ASTM D 746 | No Failure @ -35° F (-37° C) |
| Stiffness in Flexure | ASTM D 747 | 700 psi (4.82 Mpa) min. |
| Specific Gravity | ASTM D 792 | 1.38 max. |
| Hardness, Shore A | ASTM D 2240 | 79 \pm 3 |
| Tensile Strength after accelerated extraction | CRD-C 572 | 1600 psi (9.54 Mpa) min. |
| Elongation after accelerated extraction | CRD-C 572 | 300% min. |
| Effect of Alkalies after 7 days: Weight Change Hardness Change | CRD-C 572 | between -0.10% / +0.25% +/- 5 points |

2.02 ACCESSORIES

- A. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.

- B. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.
- C. Provide Teflon coated thermostatically controlled waterstop splicing irons for field butt splices.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Field butt splices shall be heat fused welded using a Teflon coated thermostatically controlled waterstop splicing iron at approximately 380 degrees F. Follow approved manufacturer recommendations. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
- B. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12 inches on center along the length of the waterstop and wire tie to adjacent reinforcing steel.
- C. Install waterstops prior to concrete placement to ensure proper positioning and concrete consolidation around the waterstop. Take care during placement of concrete to ensure that the waterstop remains correctly positioned with respect to the joint and does not fold over during placement of the concrete.
- D. Install waterstops in accordance with manufacturer's installation requirements.

3.02 FIELD QUALITY CONTROL

- A. Waterstop splicing defects which are unacceptable include, but are not limited to the following:
 - 1. Tensile strength less than 80 percent of parent section.
 - 2. Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch.
 - 3. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness.
 - 4. Misalignment that reduces waterstop cross section more than 15 percent.
 - 5. Visible porosity in the weld.
 - 6. Bubbles or inadequate bonding.
 - 7. Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.
 - 8. Charred or burnt material.

END OF SECTION

SECTION 03301

CONCRETE AND REINFORCING STEEL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install all concrete work complete as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data for:
1. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water cement ratio, product data and chemical analysis of cement
 2. Placing drawings and bar bending details in conformity with the recommendations of ACI 315.
 3. Technical data on all materials and components.
 4. Material Safety Data Sheets (MSDS) for all concrete admixtures and curing agents.
- B. Test Reports
1. Sieve analysis, mechanical properties, mortar bar expansion test results, and deleterious substance content for fine and coarse aggregates.
 2. Concrete mixes: For each formulation of concrete proposed for use, submit constituent quantities per cubic yard, water cementitious ratio, concrete slump, air content, type and manufacturer of cement. Provide either a. or b., below, for each mix proposed.
 - a. Standard deviation data for concrete mixes based on statistical records.
 - b. Water cementitious ratio curve for concrete mixes based on laboratory tests. Provide average cylinder strength test results at 7 and 28 days for laboratory concrete mix designs. Provide results of 14 day tests if available.
- C. Certifications
1. Certify that admixtures used in the same concrete mix are compatible with each other and the aggregates.

2. Certificate of conformance for concrete production facilities from NRMCA or NYSDOT.

1.03 REFERENCE STANDARDS

A. ASTM International

1. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
3. ASTM C33 - Standard Specification for Concrete Aggregates.
4. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
6. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete
7. ASTM C150 - Standard Specification for Portland Cement
8. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
9. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
10. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
11. ASTM C311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete.
12. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
13. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Portland Cement Concrete.
14. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. American Concrete Institute (ACI).

1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 2. ACI 232.2R - Use of Fly Ash in Concrete
 3. ACI 301 - Specification for Structural Concrete.
 4. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 5. ACI 305R - Hot Weather Concreting.
 6. ACI 306R - Cold Weather Concreting.
 7. ACI 315 - Details and Detailing of Concrete Reinforcement.
 8. ACI 318 - Building Code Requirements for Structural Concrete.
 9. ACI 350 - Code Requirement for Environmental Engineering Concrete Structures.
- C. Concrete Reinforcing Steel Institute (CRSI)
1. MSP - Manual of Standard Practice
- D. National Ready Mixed Concrete Association (NRMCA)
1. Quality Control Manual, Section 3- Certification of Ready Mixed Concrete Production Facilities
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

- A. Comply with ACI 318, ACI 350 and other stated specifications, codes and standards. Apply the most stringent requirements of stated specifications, codes, standards, and this Section when conflicts exist.
- B. If, during the progress of the work, it is impossible to secure concrete of the specified workability and strength with the materials being furnished, the Owner's Representative may order such changes in proportions or materials, or both, as may be necessary to secure the specified properties. Make all changes so ordered at the no additional cost to the Owner.
- C. All field testing and inspection services and related laboratory tests required will be provided by the Owner. The cost of such work will be paid for by the Owner. Methods of testing will comply with the latest applicable ASTM methods.

- D. Develop concrete mixes and their testing by an independent testing laboratory engaged by and at the expense of the Contractor. Methods of testing shall comply with the latest applicable ASTM methods.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Ship and store reinforcing steel with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same designations as those shown on the submitted placement drawings. Provide reinforcing steel free from mill scale, loose rust, mud, dirt, grease, oil, ice or other foreign matter. Store off the ground, protect from moisture and keep free from rust, mud, dirt, grease, oil, ice or other injurious contaminants.
- B. Store products in conformity with the manufacturer's recommendations.
- C. Store or stockpile sand, aggregates, cement and fly ash in conformity with ACI 301.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.
- C. Materials shall comply with this Section and any applicable State or local requirements.

2.02 MATERIALS

- A. Cement: Domestic portland cement conforming to ASTM C150. Do not use air entraining cements. The allowable types of cement for each class of concrete are shown in Table 1.
- B. Fine Aggregate: Washed inert natural sand conforming to ASTM C33.
- C. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to ASTM C33, size 57. Limits of deleterious substances and physical property requirements as listed in ASTM C33, Table 4 for severe weathering regions.
 - 1. The fine and coarse aggregates used shall not cause expansion of mortar bars greater than 0.1 percent in 16 days when tested in accordance with ASTM C1260 and using the cement proposed for the project. If aggregates proposed for use do not meet this requirement, then satisfy either a. or b. below.

- a. Total equivalent alkali content of the cement used shall not exceed 0.60 percent as provided in the Optional Chemical Requirements of ASTM C150.
 - b. The fine and coarse aggregates used shall not cause expansion of mortar bars greater than 0.1 percent in 16 days when tested in accordance with ASTM C1260 and using the cement and fly ash proposed for the project.
- D. Water: Potable water free of oil, acid, alkali, salts, chlorides, (except those attributable to drinking water) organic matter, or other deleterious substances.
- E. Admixtures: Use admixtures free of chlorides and alkalis (except for those attributable to drinking water). The admixtures shall be from the same manufacturer when it is required to use more than one admixture in the same concrete mix. Use admixtures compatible with the concrete mix including other admixtures.
1. Air Entraining Admixture: Conforming to ASTM C260. Proportion and mix in accordance with manufacturer's recommendations.
 2. Water Reducing Admixture: Conforming to ASTM C494, Type A. Proportion and mix in accordance with manufacturer's recommendations.
 3. Do not use admixtures causing retarded or accelerated setting of concrete without written approval from the Owner's Representative. Use retarding or accelerating water reducing admixtures when so approved.
- F. Fly Ash: Class F fly ash complying with ASTM C618, including the requirements of Table 1 but with the Loss of Ignition (LOI) limited to 3 percent maximum and the optional physical requirements of Table 3.
- G. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.
- H. Reinforcing Steel Accessories
1. Plastic Protected Wire Bar Supports: CRSI Bar Supports, Class 1 - Maximum Protection.
 2. Stainless Steel Protected Wire Bar Supports: CRSI Bar Supports, Class 2 - Moderate Protection with legs made wholly from stainless steel wire.
 3. Precast Concrete Bar Supports: CRSI Bar Supports, Precast Concrete Bar Supports. Precast concrete blocks that have equal or greater strength than the surrounding concrete.
- I. Tie Wires for reinforcement: 16 gauge or heavier black annealed wire.
- J. Premolded Joint Filler

1. Premolded Joint Filler – Structures: Self-expanding cork premolded joint filler conforming to ASTM D1752, Type III. Provide 1-in thickness unless otherwise indicated on the Drawings.

2.03 MIXES

- A. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce placeable, durable concrete conforming to these Specifications. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing free water to collect on the surface.
- B. Base concrete mixes on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if not available, develop concrete mixes by laboratory tests using the materials proposed for the work. Testing laboratory shall be engaged by and at the expense of the Contractor. Acceptance of mixes based on standard deviation shall be based on the modification factors for standard deviation tests contained in ACI 318. Acceptance of mixes based on laboratory tests shall be based on strengths greater than the specified design strengths specified in Table 1. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to the required average compressive strength in Table 5.3.2.2 of ACI 318. The resulting mix shall not conflict with the limiting values for maximum water cement ratio and net minimum cementitious content as specified in Table 1.
- C. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the compression strength requirements in conformity with the provisions of ACI 318.
- D. Entrained air, as measured by ASTM C231, shall be as shown in Table 1 (footnote 6).
- E. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1.
- F. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of the other admixture(s).

TABLE 1

| Class | Design Strength (1) | Cement ASTM C150 | Cementitious Content (2) | W/C (3) | WR (4) | Fly Ash (5) | Slump Range Inches |
|-------|------------------------|------------------|-----------------------------|-------------|-----------|----------------|-----------------------|
| D | 4000 | Type II | 560 | 0.44 max | Yes | Yes | 3-5 |

TABLE 1 NOTES:

- (1) Minimum compressive strength in psi at 28 days
- (2) Minimum cementitious content in lbs per cubic yard (where fly ash is used, cementitious content is defined as cement content plus fly ash content)
- (3) W/C is Maximum Water Cementitious ratio by weight
- (4) WR is water reducing admixture
- (5) Fly ash content in the range of 20-25 percent of the total cement content plus fly ash content, by weight
- (6) All concrete classes shall have 3.5 to 5 percent air entrainment

2.04 MEASURING, BATCHING, MIXING AND TRANSPORTING CONCRETE

- A. Measure, batch, mix and transport concrete in conformance with ASTM C94 and the requirements herein or as otherwise approved in writing by the Owner's Representative.
- B. Ready-mixed concrete, whether produced by a concrete supplier or the Contractor shall conform to the requirements above. Do not hand mix.
- C. Dispense admixtures into the batch in conformity with the recommendations of the admixture manufacturer.
- D. Mix concrete until there is uniform distribution of the materials and discharge completely before the mixer is recharged. The mixer shall be rotated at a speed recommended by the mixer manufacturer and mixing shall be continued for at least 1-1/2 minutes after all the materials are in the mixer. Place concrete within 1-1/2 hours of the time at which water was first added, otherwise it will be rejected. Concrete which has been remixed or retempered, or to which an excess amount of water has been added, will also be rejected.

2.05 FORMS

- A. Provide forms free from roughness and imperfections, watertight and braced and tied to prevent motion when concrete is placed. Wooden spreaders will not be allowed in the concrete.
- B. Wire ties will not be allowed. Metal ties or anchorages which are necessary within the forms shall be so constructed that the metal work can be removed for a depth of at least 1-1/2-in from the concrete surface without damage by spalling. Clean forms before using and treat with form release agent, or other approved material.

- C. All exposed edges of the finished concrete shall be chamfered 3/4-in.

PART 3 - EXECUTION

3.01 CONSTRUCTION JOINTS

- A. Locate construction joints where indicated or where approved by the Owner's Representative.
- B. Continue all reinforcing steel through the joint.
- C. At construction joints and at concrete joints indicated to be "roughened", uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points and side to side) of 1/4-in with chipping tools to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding. At least two hours before and again shortly before the new concrete is deposited, saturate the joints with water. After glistening water disappears, coat joints with neat cement slurry mixed to the consistency of very heavy paste. The surfaces shall receive a coating at least 1/8-in thick, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before the neat cement dries.

3.02 REINFORCING STEEL

- A. Fabricate reinforcing steel accurately to the dimensions shown. Bend bars around a revolving collar having a diameter of not less than that recommended in ACI 318. All bars shall be bent cold.
- B. Provide tension lap splices in compliance with ACI 318. Stagger splices in adjacent bars where possible. Provide Class B tension lap splices at all locations unless otherwise indicated.
- C. Lap splices in welded wire fabric in accordance with the requirements of ACI 318 but not less than 12-in. Tie the spliced fabrics together with wire ties spaced not more than 24-in on center and lace with wire of the same diameter as the welded wire fabric. Offset splices in adjacent widths to prevent continuous splices.
- D. Use precast concrete blocks where the reinforcing steel is to be supported over soil. Use stainless steel supports or plastic tipped metal supports in all other locations unless otherwise noted on the Drawings or specified herein.
- E. Before placing in position, clean reinforcement of loose mill scale and rust, mud, dirt, grease, oil and other coatings, including ice that reduce or destroy bond. When there is a delay in depositing concrete after the reinforcement is in place, bars shall be reinspected and cleaned again when necessary.
- F. Coat reinforcement which is to be exposed for a considerable length of time after being placed with a heavy coat of cement grout.

- G. Do not cover any reinforcing steel with concrete until the amount and position of the reinforcement has been checked and the Owner's Representative has given permission to proceed.

3.03 INSPECTION AND COORDINATION

- A. Batching, mixing, transporting, placing and curing of concrete shall be subject to the inspection of the Owner's Representative at all times. Advise the Owner's Representative of readiness to proceed at least six working hours prior to each concrete placement. The Owner's Representative will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing and the alignment, cleanliness and tightness of formwork. Do not place concrete without the inspection and acceptance of the Owner's Representative.

3.04 CONCRETE APPEARANCE

- A. Remix concrete showing either poor cohesion or poor coating of the coarse aggregate with paste. If this does not correct the condition, the concrete shall be rejected.
- B. Provide concrete having a homogeneous structure which, when hardened, will have the specified strength, durability and appearance. Provide mixtures and workmanship such that concrete surfaces, when exposed, will require no finishing except as specified herein.

3.05 PLACING AND COMPACTING

- A. Reinforcement, where required, shall be accurately placed in exact positions shown, shall be secured against displacement with annealed iron wire ties or suitable clips at intersections and shall have a clear space of 2-in between the steel and face of forms unless otherwise indicated. Wire ties passing through the forms for the purpose of holding the steel in proper position will not be allowed. Reinforcing bars shall be free from rust, scale, dirt, grease and injurious contaminants.
- B. Do not place concrete until forms, condition of subgrade and method of placement have been approved by the Owner's Representative. Remove all debris, foreign matter, dirt, ice and standing water from the forms before depositing concrete. Do not place concrete on frozen subgrade, snow or ice. The contact surface between concrete previously placed and new concrete shall be cleaned and brushed with cement paste. Concrete, except as indicated on the Drawings, shall not be placed in water or submerged within 24 hours after placing, nor shall running water be permitted to flow over the surface of fresh concrete within 4 days after its placing.
- C. Deposit concrete as near its final position as possible to prevent segregation due to rehandling or flowing. Pumping of concrete will be permitted when an approved design mix and aggregate sizes suitable for pumping are used. Do not

deposit concrete which has partially hardened or which has been contaminated by foreign materials. If the section cannot be placed continuously, place construction joints as specified or as approved. Place concrete for walls using tremie tubes in 12-in to 24-in lifts, keeping the surface horizontal. Do not drop concrete more than 4-ft.

- D. Use high frequency mechanical vibrators to obtain proper consolidation of the concrete. Do not use vibrators to move or transport concrete in the forms. Do not over-vibrate so as to segregate. Continue vibration until the frequency returns to normal, trapped air ceases to rise and the surface appears liquefied, flattened and glistening. Use spades, rods or forks so that concrete is completely worked around reinforcement, embedded items, pipe stubs, and openings and into corners of forms.

3.06 CURING AND PROTECTION

- A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.
- B. Cure all concrete in conformance with ACI 301 by water curing. Water curing shall be by ponding, by continuous sprinkling or by covering with continuously saturated burlap.
- C. Protect finished surfaces and slabs from the direct rays of the sun to prevent checking and crazing.
- D. During cold weather concrete shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 306R. Do not use salt, manure or other chemicals for cold weather protection.
- E. During hot weather concrete shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints. Immediately cover plastic concrete with curing material during hot weather.

3.07 FIELD TESTS

- A. Sets of field control cylinder specimens will be taken by the Owner's Representative during the progress of the work, in compliance with ASTM C31. The number of sets of concrete test cylinders taken of each class of concrete placed each day will not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls. Specimens will be formed in 6-in diameter by 12-in long non-absorbent cylindrical molds.
 - 1. A "set" of test cylinders shall consist of four cylinders: one to be tested at seven days and two to be tested and their strengths averaged at 28 days. The

fourth may be used for a special test at 3 days or to verify strength after 28 days if 28 day test results are low.

2. When the average 28 day compressive strength of the cylinders in any set falls below the required compressive strength or below proportional minimum seven-day strengths (where proper relation between seven and 28 day strengths have been established by tests), change proportions, cementitious content, or temperature conditions to achieve the required strengths at no additional cost to the Owner.
- B. Cooperate in the making of tests by allowing free access to the work for the selection of samples. Provide an insulated closed curing box for the specimens and protect the specimens against injury or loss through construction operations. Furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Owner.
 - C. Slump tests will be made in the field by the Owner's Representative in conformity with ASTM C143.
 - D. Tests for air content will be made in the field by the Owner's Representative in compliance with either the pressure method (ASTM C231) or by the volumetric method (ASTM C173).

3.08 STRIPPING AND FINISHING CONCRETE

- A. Do not remove forms before the concrete has attained a strength of at least 70 percent of the specified design strength nor before reaching approximately "100 degree-days" of moist curing (whichever is the longer). Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (e.g., 7 days at an average 50 degrees F = 350 degree-days).
- B. Exercise care to prevent damaging edges or obliterating the lines of chamfers, rustications or corners when removing the forms or doing any other work adjacent thereto.
- C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the Owner's Representative.
- D. Immediately after removal of forms remove tie cones and metal portions of ties. Fill holes promptly upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spider web. Trowel smooth with heavy pressure. Avoid burnishing.

- E. Defective concrete and honeycombed areas: Chip down square and at least 1-in deep to sound concrete with hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded in the parent concrete. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/8-in wide all around the steel. For areas less than 1-1/2-in deep, the patch may be made in the same manner as described above for filling form tie holes, care being exercised to use adequately dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs will require build-up in successive 1-1/2-in layers on successive days, each layer being applied (with slurry, etc.) as described above.
- F. Concrete not exposed in the finished work shall have off-form finish with fins and other projections removed and tie cones and defects filled as specified above.
- G. Finish slabs by screeding and floating with straightedges to bring the surfaces to the elevations indicated. Screed top surface of slabs to the established grades and to a true plane with a tolerance of 1/8-in when checked with a 10-ft straightedge. Pitch surface to drain unless otherwise noted on the Drawings. Finish the surface to give a smooth, hard, even surface free from high or low spots or other defects. Concrete subject to pedestrian traffic shall be given a broom finish. Failure to meet these conditions shall be cause for removal, grinding, or other correction as directed by the Owner's Representative.

3.09 SCHEDULE

- A. The following (Table 2) are the general applications for the various concrete design strengths to be used:

TABLE 2

| Class | Design Strength (psi) | Description |
|-------|-----------------------|------------------------------------------------|
| D | 4,000 | Slabs, piers and all other structural concrete |

* * * * *

END OF SECTION

SECTION 05500

STRUCTURAL STEEL AND MISCELLANEOUS METALS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Bolts, Connectors, and Anchors.
 - 3. Metal Grating.
 - 4. Railings.
 - 5. All other miscellaneous metals as shown on the drawings and as specified herein.

1.02 REFERENCE DOCUMENTS

- A. American Hot-Dip Galvanizers Association, Inc./Zinc Institute
 - 1. AHDGA/ZI Manual The Design and Fabrication of Galvanized Products
- B. American Institute of Steel Construction
 - 1. AISC Specification Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings
 - 2. AISC Code Code of Standard Practice for Steel Buildings and Bridges
 - 3. AISC Manual Manual of Steel Construction
- C. American Society for Testing and Materials
 - 1. ASTM A6 Specification for General Requirements for Rolled Steel Plate, Shapes, Sheet Piling, and Bars for Structural Use
 - 2. ASTM A36 Specification for Structural Steel
 - 3. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

4. ASTM A108 Specification for Cold Finished Carbon Steel Bars and Shafting
5. ASTM A123 Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
6. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
7. ASTM A276 Standard Specification for Stainless Steel Bars and Shapes.
8. ASTM A307 Specification for Carbon Steel Externally Threaded Standard Fasteners
9. ASTM A325 Specification for High-Strength Bolts for Structural Steel Joints
10. ASTM A386 Specification for Zinc Coating (Hot-Dip) on Assembled Steel Products
11. ASTM A413 Specification for Carbon Steel Chain
12. ASTM A500 Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing
13. ASTM A501 Specification for Hot Formed Welded and Seamless Carbon Steel Structural Tubing
14. ASTM A563 Specification for Carbon and Steel Alloy Nuts
15. ASTM A569 Specification for Hot-Rolled Carbon Steel Sheet and Strips of Commercial Quality
16. ASTM A786 Specification for Rolled Steel Floor Plate
17. ASTM A992 Specification for Structural Steel Wide Flange Shapes
18. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

D. American Welding Society

1. AWS D1.1 Structural Welding Code
2. AWS D1.6 Structural Welding Code - Stainless Steel

- 3. AWS A5.1 through A5.23 Filler Metal Specifications
- E. National Association of Architectural Metal Manufacturers
 - 1. NAAMM Manual Metal Bar Grating Manual
- F. National Association of Corrosion Engineers
 - 1. T.M.01 Visual Standards for Surface of New Steel Airblast Cleaned with Sand Abrasive
- G. American Society for Nondestructive Testing
 - 1. SNT-TC-1A Recommended Practices, Nondestructive Testing - Personnel Qualification and Certification
- H. Steel Structures Painting Council
 - 1. SSPC SP1: Solvent Cleaning
 - 2. SSPC SP5: White Metal Blast Cleaning
 - 3. SSPC SP6: Commercial Blast Cleaning
 - 4. SSPC SP10: Near-White Blast Cleaning
 - 5. SSPC PA1: Shop, Field, and Maintenance Painting
 - 6. SSPC PA2: Method for Measurement of Dry Paint Thickness with Magnetic Gages
 - 7. SSPC PS12: Guide to Zinc-Rich Coating Systems
- I. Occupational Safety and Health Administration (OSHA)

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
- C. Erection Plan.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator
- B. Welding certificates.

- C. Mill test reports for structural steel, including chemical and physical properties.
- D. Source quality-control reports.
- E. Field quality-control and special inspection reports.
- F. Submit calculations demonstrating that the railings will resist the loads specified in the International Building Code at the post spacing provided.
- G. Submit manufacturer's load and deflection tables for grating.

1.05 QUALITY ASSURANCE

- A. Qualifications
 - 1. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
 - 2. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
 - 3. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Tests by the Contractor
 - 1. The Contractor shall perform and require its subcontractors and vendors to perform sufficient testing and inspection to ensure that the products supplied are of good quality. Records of any and all tests and inspections shall be maintained in the Seller's file.
 - 2. Shop Welding
 - a. The Contractor shall be responsible for the inspection and verification of all shop welding to the requirements of Section 6, 8, and 9 of AWS D1.1.
 - b. A visual inspection is the minimum inspection required.

- c. The shop weld inspection shall be performed by an AWS Certified Inspector, or Assistant Welding Inspector(s), under the supervision of the AWS Certified Inspector. Alternatively, implement a program for self-certification of welding inspectors, provided the program is written and is supervised by an AWS Certified Inspector in compliance with the requirements of AWS D1.1, Sections 6 and 8. Copies of the written Weld Inspection Program, including the Inspector's certification records, shall be filed and be available to the Owner's Representative if requested.

3. Field Welding

- a. The Contractor shall be responsible for the fabrication/erection inspection of all field welding to the requirements of Section 6, 8, and 9 of AWS D1.1.
- b. A visual inspection is the minimum inspection required. See Paragraph 2.05 for additional requirements.

D. Inspection

1. The following are the mandatory hold points for which prior notification is required:
 - a. Leveling and Plumbing of the structure
 - b. Final bolt torquing operations.
 - c. Completion of high-strength bolting and/or field welding operations in an area.

E. Inspection Access and Tools

1. The Contractor shall provide the necessary means of safe access to allow the Owner's Representative to perform required inspection.
2. If the method of high-strength bolt tightening requires the use of a calibration device capable of indicating bolt tension and/or a torque wrench to perform inspection, these devices shall be supplied by the Contractor. These devices shall be of sufficient size, capacity, and accuracy for the job and capable of producing consistent repeatable results.

1.06 PRODUCT HANDLING

- A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.
- B. Repair items that have become damaged or corroded to the satisfaction of the Owner's Representative prior to incorporating them into the work.

1.07 PROJECT/SITE REQUIREMENTS

- A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.02 STEEL MATERIALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Structural Steel ASTM A36
- C. Structural Steel Tubing ASTM A500, Grade B
- D. Welded and Seamless Steel Pipe ASTM A501 or ASTM A53, Type E or S, Grade B Schedule 40. Use standard malleable steel fittings, galvanized for exterior work
- E. Stainless Steel Plates, Sheets, and Structural Shapes
 - 1. Exterior, Submerged, or Industrial Use ASTM A240, Type 316 (Type 316L for welded)
- F. Stainless Steel Bolts, Nuts, and Washers ASTM A276, Type 316
- G. Carbon Steel Bolts and Studs ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)
- H. High Strength Steel Bolts, Nuts, and Washers ASTM A325 (mechanically galvanized per ASTM B695, Class 50, where noted)
 - 1. General Application Type I or Type II

- | | | |
|----|-----------------------|-----------------------------------------|
| I. | Galvanizing | ASTM A123, Zn w/0.05 percent minimum Ni |
| J. | Galvanizing, hardware | ASTM A153, Zn w/0.05 percent minimum Ni |

2.03 BOLTS, CONNECTORS, AND ANCHORS

- A. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip zinc coating
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.
- B. Headed Anchor Rods: ASTM F 1554, Grade 36, straight with heavy hex head
 - 1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C
- C. Threaded Rods: ASTM A 193/A 193M
 - 1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C
- D. Hilti bolts shall be ASTM A193 B7 bolts.

2.04 METAL GRATING

- A. Grating shall have rectangular, 3/16-in thick, bearing bars spaced 1-3/16-in on center with cross bars spaced at 4-in on center. All grating panels shall be banded all around with a bar the same size as the bearing bars.
 - 1. Grating shall be of the same depth shown on the Drawings, not exceed the fabricator's maximum recommended span, and meet or exceed the following load and deflection criteria for the maximum span length at the opening being covered by the grating.
 - a. The grating shall produce a deflection of 1/360 of the span or less under a uniform live load of 200 lbs/sq ft on the maximum span.
 - b. The grating shall produce a deflection of 1/360 of the span or less under a concentrated live load of 300 lbs applied at the mid-point of the maximum span.
 - 2. Openings 2-in or greater in diameter/dimension and grating edges shall be banded with a bar of the same depth and thickness as the bearing bars. Cut bearing bars or cross bars shall be welded to the banding bar.

3. Provide trench grating with symmetrical cross bar arrangement.
4. Grating clamps, nuts, bolts, washers and other fastening devices for grating and grating supports shall be Type 316 stainless steel. Anchor blocks, when used, shall be of the same material as the grating. All grating shall be anchored to the supporting system using saddle clips.

2.05 RAILINGS

- A. Handrail and railing systems shall comply with the requirements of OSHA and IBC.
- B. Railings shall be 2 rail welded railing systems, as shown on the Drawings, fabricated with 1-1/2-in nominal diameter pipe. Posts shall be Schedule 80 pipe, minimum and rails and handrail shall be Schedule 40 pipe, minimum. Posts and top rails shall be continuous. Spacing of posts shall not exceed 5-ft on center and shall be uniformly spaced except as otherwise shown on the Drawings. Posts will be required on each side of structure expansion joints. All railing posts shall be vertical.
- C. Welds shall be circumferential welds ground smooth and even to produce a railing that is neat in appearance and structurally sound. Welding methods shall be in conformity with AWS standards for the materials being joined. All rails to post connections shall be coped and fastened by continuous welds. There shall be no burrs, sharp edges or protrusions on any weld on any part of the handrail system. After fabrication, the welds and surrounding area shall be cleaned and hand buffed to blend with the adjacent finish. All mechanical fasteners shall be unobtrusively located in countersunk holes with the top flush with the surface of the rail. Bends in the railing shall be as indicated by the Drawings. No distortion of the circular railing shape will be allowed. Bends and terminal sections shall be made without the use of fittings. Corner bends shall be mitered and welded bends.
- D. Railing shall be assembled in sections as long as practical but shall not be greater than 24-ft in length. A field splice shall be used when an assembled section is to be attached to another section. Field splices shall be used in all railing panels that cross over structure expansion joints.
 1. Field splices shall use internal splice sleeves located within 8-in of railing posts. The sleeve shall be welded to the rail on one side and fastened with a set screw to the rail on other side. The field splice shall be detailed to take the differential expansion between the railing system and the supporting structure.
 2. When the field splice occurs in a railing panel crossing a structure expansion joint, the sleeve shall be welded to the rail on one side and be free to slide in the rail on other side. The field splice shall be detailed to take the same movement as the structure expansion joint.
- E. The bases or supports for railing posts and handrail shall be the types indicated on the Drawings.

1. Where handrail is to be fastened to walls, the rails shall be provided with screwed wall flanges fastened to the walls with three 3/8-in stainless steel flat head machine screws. The horizontal projection of the handrail support off the wall shall provide 2-1/2-in minimum clearance below the bottom of the handrail.

2.06 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 1. Provide vent or fill holes in closed fabricated sections that will be galvanized.
 2. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 3. Unless otherwise specified all steel shall be galvanized. Wrap steel and hold back galvanization 3" from those areas that will be field welded.

2.07 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
- B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- C. Field verify all dimensions and elevations prior to fabrication.

2.08 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
- B. Joint Type: Joint Type: Snug-Tightened
- C. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.09 SOURCE QUALITY CONTROL

- A. Testing Agency: Contractor will engage a manufacturing facility with a certified quality control and inspection program. The manufacturing shop shall certify the following:

1. Shop-bolted connections have been inspected and conform to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
 2. Welded connections have been inspected and conform to the requirements of AWS D1.1.
- B. Galvanizing
1. After fabrication and before assembly, carbon steel components, structural members and fasteners to be galvanized shall be degreased, cleaned of rust and scale, prefluxed, and hot dipped galvanized. The zinc (hot galvanized) coatings applied to the fabricated products shall be in accordance with ASTM A123 and all of the incorporated specifications and recommended practices of the ASTM referenced therein, except as otherwise required or permitted herein. Additionally, hot-dip galvanizing and fabrication of items for hot dip galvanizing should conform to the standards and guidelines set forth in AHDGA/ZI Manual.
 2. Precautions shall be taken to avoid distortion or warpage of members during galvanizing. The procedures suggested in ASTM A384 and AHDGA/ZI Manual shall be observed. Material failing to meet the required criteria for straightness and length shall be subject to rejection.
 3. For hardware items such as bolts, nuts, clevises, clips, etc, the galvanizing shall conform with the requirements of ASTM A153.
 4. Galvanized material shall have an undamaged surface coating when it leaves the fabricator's shop.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
5. Baseplates, Bearing Plates and leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

6. Set plates for structural members on wedges, shims, or setting nuts as required.
 7. Weld plate washers to top of baseplate.
 8. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 9. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
 10. Anchor top bearing plates of the new assembly must be in full contact with the top plate of the existing bearing bracket. Height of the frame assembly (tube and plate) to be set in a manner to ensure full even bearing between top plate and top plate of existing bearing bracket. Assemblies that do not have full even bearing shall be removed and reset.
- B. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.
- C. Specialty products shall be installed in accordance with the manufacturer's recommendations.
- D. Install adhesive capsule anchors using manufacturer's recommended drive units and adapters and in compliance with the manufacturer's recommendations.
- E. All railings shall be erected to line and plumb.
- F. All steel surfaces that come into contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.
- G. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

3.03 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug-Tightened
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.
- C. Field galvanize those surfaces where the galvanization was held back due to welding and those galvanized surfaces that were damaged during installation.

3.04 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

* * * * *

END OF SECTION

SECTION 15151

SLIDE GATES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall supply gates and shall furnish all labor, equipment and incidentals required to install, ready for operation and field test stainless steel gates and appurtenances as shown on the Contract Drawings and as specified herein.
- B. The gates and appurtenances shall comply with the requirements of AWWA C561-04 Standard for Fabricated Stainless Steel Slide Gates as modified herein. The allowable leakage rate for the stainless steel gates in this specification shall be one half the allowable leakage listed in the latest revision of AWWA C561-04.

1.02 SUBMITTALS

- A. Provide the following information to confirm compliance with the specification in addition to the submittal requirements specified in AWWA C561-04.
 - 1. Complete description of all materials including the material thickness of all structural components of the frame and slide.
 - 2. Installation drawings showing all details of construction, details required for installation, dimensions and anchor bolt locations.
 - 3. Maximum bending stress and deflection of the slide under the maximum design head.
 - 4. The location of the company headquarters and the location of the principle manufacturing facility. Provide the name of the company that manufactures the equipment if the supplier utilizes an outside source.

1.03 QUALITY ASSURANCE

- A. Qualifications
 - 1. All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 20 years experience designing and manufacturing water control gates. The manufacturer shall have manufactured water control gates for a minimum of 100 projects.

PART 2 - EQUIPMENT

2.01 GENERAL

- A. Gates shall be as specified herein and have the characteristics and dimensions shown on the Contract Drawings.
- B. The gate shall utilize self-adjusting seals. Due to the difficulty of accessing gates when they are in service, gates that utilize adjustable wedges, wedging devices or pressure pads are not acceptable.
- C. All structural components of the frame and slide shall be fabricated of stainless steel having a minimum thickness of 3/8-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
- D. All welds shall be performed by welders with AWS D1.6 certification.
- E. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale. All iron and steel components shall be properly prepared and shop coated with a primer.
- F. Materials:

Components

Frame Assembly and Retainers
 Slide and Stiffeners
 Stem
 Anchor Studs, Fasteners and Nuts
 Invert Seal (Upward Opening Gates Only)
 Seat/Seals and Facing

 Lift Nuts
 Pedestals and Wall Brackets
 Operator Housing

Materials

Stainless Steel, Type 304L, ASTM A240
 Stainless Steel, Type 304L, ASTM A240
 Stainless Steel, Type 304, ASTM A276
 Stainless Steel, Type 316, ASTM A276
 Neoprene ASTM D-2000 or EPDM
 Ultra-High Molecular Weight Polyethylene
 ASTM D4020
 Bronze ASTM B584
 Stainless Steel, Type 304L, ASTM A276
 Cast aluminum or ductile iron

2.02 FRAME

- A. The frame assembly, including the guide members, invert member and yoke members, shall be constructed of formed stainless steel plate with a minimum thickness of 3/8-inch.
 - 1. Frame design shall allow for embedded mounting, mounting directly to a wall with stainless steel anchor bolts and grout or mounting to a wall thimble with stainless steel mounting studs and a mastic gasket material. Mounting style shall be as shown on the Contract Drawings.
 - 2. All wall mounted or wall thimble mounted gates shall have a flange frame. Flat frame gates are not acceptable.
 - 3. The structural portion of the frame that incorporates the seat/seals shall be

formed into a one-piece shape for rigidity. Guide members that consist of two or more bolted structural members are not acceptable. Guide member designs where water loads are transferred through the assembly bolts are specifically not acceptable.

4. Gussets shall be provided as necessary to support the guide members in an unseating head condition. The gussets shall extend to support the outer portion of the guide assembly and shall be positioned to ensure that the load is transferred to the anchor bolts or the wall thimble studs.
5. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully closed or fully opened position.
6. On self-contained gates, a yoke shall be provided across the top of the frame. The yoke shall be formed by two structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The yoke shall be designed to allow removal of the slide.
7. A rigid stainless steel invert member shall be provided across the bottom of the opening. The invert member shall be of the flushbottom type on upward opening gates and shall be embedded in non-shrink grout. The gate supplier shall provide embed requirements.
8. A rigid stainless steel top seal member and gasket shall be provided across the top of the opening on gates designed to cover submerged openings.

2.03 SLIDE

- A. The slide and reinforcing stiffeners shall be constructed of stainless steel plate. All structural components shall have a minimum thickness of 3/8-inch.
 1. The slide shall not deflect more than $1/360$ of the span or $1/16$ inch, whichever is smaller, under the maximum design head.
 2. When the width of the gate opening multiplied by the maximum design head is 240 square feet or greater, the portion of the slide that engages the guide members shall be of a “thick edge” design. The thick edge portion of the slide shall have a minimum thickness of 5 inches.
 3. Reinforcing stiffeners shall be welded to the slide and mounted horizontally. Vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement.
 4. The stem connector shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

2.04 SEALS

- A. All gates shall be provided with a self-adjusting seal system to restrict leakage in accordance with the requirements listed in this specification.
1. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
 2. The seat/seals shall extend to accommodate the 1-1/2 x the height of the slide when the slide is in the fully closed or fully opened position.
 3. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member or the bottom of the slide and it shall be held in place with stainless steel attachment hardware.
 4. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
 5. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.
 6. The seals shall be mounted so as not to obstruct the water way opening.
 7. Gates that utilize rubber “J” seals or “P” seals are not acceptable.
 8. The seal system shall have been factory tested to confirm negligible wear (less than 0.01”) and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

2.05 STEM

- A. A threaded operating stem shall be utilized to connect the operating mechanism to the slide. On rising stem gates, the threaded portion shall engage the operating nut in the manual operator or motor actuator.
1. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.
 2. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.
 3. The stem shall be threaded to allow full travel of the slide unless the travel distance is otherwise shown on the Contract Drawings.
 4. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
 5. In compression, the stem shall be designed for a critical buckling load caused

by a 40 lb effort on the crank or handwheel with a safety factor of 2, using the Euler column formula.

6. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
7. The threaded portion of the stem shall have machine rolled threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.
8. Stems of more than one section shall be joined by stainless steel or bronze couplings. The coupling shall be bolted to the stems.
9. Stems, on manually operated gates, shall be provided with adjustable stop collars to prevent over closing of the slide.

2.06 STEM GUIDES

- A. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
 1. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.
 2. Adjustable in two directions.

2.07 WALL THIMBLES

- A. Wall thimbles shall be provided when shown on the Contract Drawings.
 1. The wall thimble depth shall be equal to the thickness of the concrete wall in which the thimble is to be mounted.
 2. Wall thimbles shall be fabricated stainless steel construction of adequate section to withstand all operational and reasonable installation stresses.
 3. Wall thimbles shall be constructed of 1/4-inch minimum thickness stainless steel and the front face shall have a minimum thickness of 3/8-inch.
 4. The fabrication process shall ensure that the wall thimble is square and plumb and the front face is sufficiently flat to provide a proper mounting surface for the gate frame.
 5. The face of the wall thimble shall only be machined if recommended by the gate manufacturer. If the wall thimble is to be machined, the front face shall have a minimum thickness of 3/8-inch after machining.
 6. A water stop shall be welded around the periphery of the thimble. Wall

thimbles shall be designed to allow thorough and uniform concrete placement during installation. Water stop may be stitch welded.

7. Studs and nuts shall be stainless steel.
8. A suitable gasket or mastic shall be provided to seal between the gate frame and the wall thimble.

2.08 MANUAL OPERATORS

- A. Unless otherwise shown on the Drawings, gates shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on the yoke of self contained gates or on the pedestal of non-self contained gates.
 1. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb effort when the gate is in the closed position and experiencing the maximum operating head.
 2. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.
 3. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
 - a. Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - b. Handwheel operators shall be equipped with roller bearings above and below the operating nut.
 - c. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - d. The handwheel shall be removable and shall have a minimum diameter
 4. Crank-operated gearboxes shall be fully enclosed and shall have a cast aluminum or ductile iron housing.
 - a. Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
 - b. Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - c. Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.
 - d. Gears shall be steel with machined cut teeth designed for smooth

operation.

- e. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.
 - f. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - g. The crank shall be cast aluminum or cast iron with a revolving nylon grip.
 - h. The crank shall be removable.
5. All gates having widths in excess of 72 inches and widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation.
- a. Interconnecting shafting shall be constructed of aluminum or stainless steel.
 - b. Flexible couplings shall be provided at each end of the interconnecting shaft. Couplings shall be stainless steel or non-metallic.
 - c. One crank shall be provided to mount on the pinion shaft of one of the gearboxes.
6. An extended operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the crank or handwheel, on a non-gear operator, is located over 48 in above the operating floor. Chain wheels are not acceptable.
- a. A removable stainless steel or aluminum cover shall be provided to enclose chain and sprockets.
 - b. The extended operator system shall lower the centerline of the pinion shaft to 36 in above the operating floor.
 - c. A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60-in or less above the operating floor.
7. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
- a. The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36 in above the operating floor.

- b. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel.
 - c. Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb effort on the crank or handwheel.
 - d. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the Owner's Representative. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.
8. Operators shall be equipped with fracture resistant clear butyrate or lexan plastic stem covers.
- a. The top of the stem cover shall be closed.
 - b. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
 - c. Stem covers shall be complete with indicator markings to indicate

2.09 ANCHOR BOLTS

- A. Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances.
 - 1. Quantity and location shall be determined by the gate manufacturer.
 - 2. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts.
 - 3. Anchor bolts shall have a minimum diameter of 1/2-inch.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation of the gates and appurtenances shall be done in a workmanlike manner. It shall be the responsibility of the Contractor to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.
- B. The Contractor shall review the installation drawings and installation instruction prior to installing the gates.
- C. The gate assemblies shall be installed in a true vertical plane, square and plumb.
- D. The Contractor shall fill the void in between the gate frame and the wall with non-

shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.

- E. The Contractor shall add a mastic gasket between the gate frame and wall thimble (when applicable) in accordance with the manufacturer's recommendations.

3.02 FIELD TESTING

- A. After installation, all gates shall be field tested in the presence of the Owner's Representative and Owner to ensure that all items of equipment are in full compliance with this Section. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting. The effort to open and close manual operators shall be measured, and shall not exceed the maximum operating effort specified above. Electric motor actuators shall function smoothly and without interruption. Each gate shall be water tested by the Contractor, at the discretion of the Owner's Representative and Owner, to confirm that leakage does not exceed the specified allowable leakage.
- B. Allowable leakage under full normal head with no water on the downstream side of the gate shall be less than 0.05 gpm/foot of seating perimeter. Test duration shall be at least 30 minutes. The Contractor shall provide the means to collect and measure leakage.
- C. Testing must be witnessed by the Owner's Representative.

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END OF SECTION