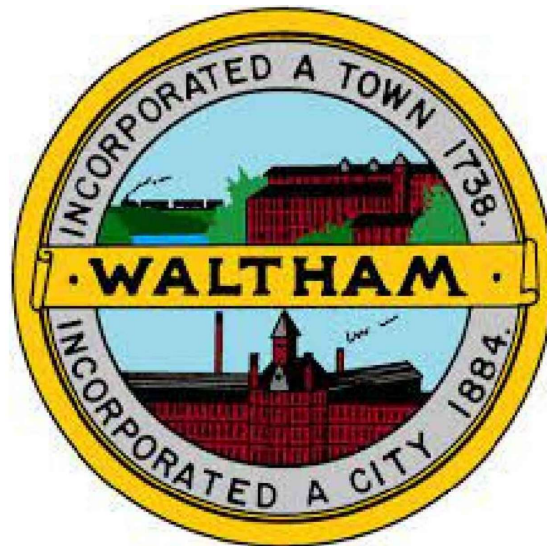


City of Waltham, MA
Chester Brook YMCA Wetland Flood
Mitigation

TECHNICAL SPECIFICATIONS

NOT FOR CONSTRUCTION



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June 2023

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SECTION 01000
GENERAL REQUIREMENTS FOR CONTRACTORS

PART 1 GENERAL

1.01 CONTRACT DOCUMENTS

- A. The Contractor's obligations shall be as defined by its Agreement with the Owner.
- B. The Engineer's responsibilities shall be as defined by its Agreement with the Owner.

1.02 SCOPE

- A. The Contractor shall provide all labor, materials, equipment and services, and perform all operations required for completion of Work of this Contract as specified and as indicated on the Contract Drawings. It is the intent of the Contract Documents to describe a fully functioning complete project that includes any labor, documentation, services, materials, or equipment that may be reasonably inferred from the Contract Documents and prevailing customs and trade usage to produce the intended result, whether or not specifically called for, at no additional costs to the Owner.

1.03 REFERENCED STANDARDS AND SPECIFICATIONS

- A. Applicable Codes, Specifications and Standards:
 - 1. Unless otherwise specified, references to Codes, specifications, standards, or other documents in the Contract Documents mean the documents in effect at the time of advertisement for bids or invitation to bid (or on the effective date of the agreement if there were no bids). References to documents mean the replacement documents issued or otherwise identified by the organization if referenced documents have been discontinued, or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given individual Sections, references to those documents mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.
 - 2. Review state and local requirements for what copies of applicable permits, Codes, and/or standards must be kept on site by the Contractor.
- B. The Contractor shall maintain on the site copies of permits, local codes governing and applicable to the Contract work, American Association of State Highway and Transportation Officials Specifications, and Department of Transportation Standard Specifications for Massachusetts.
- C. Where the publications, standards, codes or other material referenced in the specification are not required to be on site as specified in this Section, the Contractor shall, when requested by the Owner or Engineer, produce a copy of the standard, code, or specification within twenty-four (24) hours from the time of request.

1.04 PERMITS, FEES, AND CERTIFICATES

- A. The Contractor will secure (in a timely manner) and pay for all construction permits and licenses and will pay all governmental charges and inspection fees necessary for the prosecution of the Work, unless specifically stated otherwise.

1.05 COMPLIANCE WITH LAWS, ORDINANCES CURRENTLY IN EFFECT

- A. Contractor shall comply with all applicable laws, ordinances and codes of the appropriate jurisdiction having control and effect upon the work of this Contract. Before installing any work, the Contractor shall inform himself on any law, ordinance or code affecting the work; and, where this law, ordinance or code is at variance with these specifications or drawings, the Contractor shall report the discrepancy to the Engineer in writing for his resolution to remove the discrepancy.
- B. Should the Contractor elect to ignore the conditions stipulated in the paragraph above and proceed with the work or variance with any applicable ordinances or code, the Contractor shall remove any such non-conforming work, which includes any work that fails to meet the requirements of the above paragraph without cost to the Owner and proceed with the work in a manner as specified by the Engineer.
- C. Contractor shall comply with applicable laws and ordinances governing the disposal of surplus excavation, materials, debris and rubbish on or of the project and commit no trespass on any public or private property in any operation due to or connected with the work. If included, refer to Division 01 for additional guidance on construction/project waste management requirements.

1.06 TAXES

- A. The Owner is a sales tax-exempt entity.

1.07 TRAFFIC CONTROL

- A. For control of moderate traffic, the Contractor shall provide an adequate number of flagmen employed at their own expense.
- B. Whenever and wherever, in the opinion of the Engineer, traffic is sufficiently congested or public safety is endangered, the Contractor, as required, shall furnish uniformed special officers to direct traffic and keep traffic off the roadway area affected by construction operations. Such officers shall be in addition to the watchmen required under other provisions of the Contract.
- C. Pedestrian foot traffic shall be safely rerouted around the construction entrance as shown on the Contract Drawings.

1.08 INTERFERENCE WITH/AND PROTECTION OF STREETS

- A. The Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permits from the proper authorities. If any street or private way shall be rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the Engineer.

- B. Streets, roads, private ways, and walks not closed shall be maintained passable by the Contractor at his expense, and the Contractor shall assume full responsibility for the adequacy and safety of provisions made.
- C. The Contractor shall, 24 hours in advance of closing any street, notify the police and fire departments in writing, with a copy to the Engineer. They shall cooperate with the police department in the establishment of alternate routes and, at his own expense, shall provide adequate, plainly marked detour signs.
- D. The Contractor shall adhere to the City Ordinance for Lexington Street. No work is allowed on the traveled way (Lexington Street) between the hours of 6:00AM – 9:00AM and 4:00PM – 7:00PM without prior written approval by the Chief of Police.

1.09 MAINTAINING STORMWATER FLOWS

- A. It is essential to the operation of the existing drainage system that there is no interruption in the flow of drainage. To this end, the Contractor shall provide, maintain, and operate all temporary facilities such as dams, pumping equipment, sewers, conduits and all other labor and equipment necessary to intercept the flow before it reaches the points where it would interfere with his work, carry it past his work, and return it to the system below his work.

1.10 HANDLING AND DISTRIBUTION

- A. The Contractor shall handle, haul, and distribute all materials and all surplus materials on the different portions of the work, as necessary or required; shall provide suitable and adequate storage room for materials and equipment during the progress of the work, and be responsible for the protection, loss of, or damage to materials and equipment furnished by them, until the final completion and acceptance of the work.
- B. Storage and demurrage charges by transportation companies and vendors shall be borne by the Contractor.

1.11 LINES, GRADES, AND MEASUREMENTS

- A. Reference marks establishing the controlling grades are available from the Engineer. These reference marks shall be replaced at the Contractor's expense if damaged or destroyed by construction operations.
- B. The Contractor shall be responsible for detailed layout, stakeout and grade control required, and shall employ a registered land surveyor or registered professional engineer for this purpose. The Owner will provide engineering inspection.
- C. Construction staking shall consist of construction layout and reference staking necessary for the proper control and satisfactory completion of all structures, grading, paving, drainage and all other appurtenances required for the completion of the Contract and acceptance of the work.
- D. The Owner will furnish the Contractor such control points, benchmarks and other data as may be necessary for the construction staking and layout by qualified engineering or land surveying personnel. It shall be the responsibility of the Contractor to verify all such data prior to construction.

- E. Upon request of the Engineer, the Contractor shall furnish copies of all data used in setting and referencing all stakes and other layout markings used by the Contractor. The Contractor shall be responsible for the placement and for the accurate re-establishment of all baselines shown on the Plans, and for the replacement of existing survey points found on the Project and/or noted on the Plans. All brass survey pins in lead plugs and "PK" nails which are to be set or reset and are not to be set in stone bounds installed under this Contract, as noted on the Contract Drawings, are to be set or reset at no additional cost to the Authority. "PK" nails are to be galvanized, 1 ¼ inch minimum, with the letters "PK" on the head, separated by an indentation which marks the actual survey point, and shall be subject to the approval of the Engineer. All stakes, references and batterboards, including original, additional or replacements which may be required for the construction operations, shall be furnished, set and properly referenced by the Contractor. He shall be solely and completely responsible for the accuracy of the line and grade of all features of the work. Any errors or apparent discrepancies found in previous surveys, plans or in these Contract Documents shall be called to the Engineer's attention by the Contractor for correction or interpretation prior to proceeding with the work.
- F. All staking shall be performed by qualified engineering or land surveying personnel, acceptable to the Engineer. These personnel shall perform the staking under the direct supervision of a registered land surveyor or registered professional engineer. All stakes used for control staking shall be of a quality meeting the approval of the Engineer.
- G. When requested by the Engineer, the Contractor shall provide safe and convenient access to control points, batterboards and references. The Owner may make a check of the control of the work, as established by the Contractor, at any time as the work progresses. The Contractor will be informed of the results of these checks, but the Owner by so doing in no way relieves the Contractor of his responsibility for the accuracy of the layout work. The Contractor shall, at his expense, correct or replace, as required, any deficient layout and Construction work which is a result of inaccuracies in his taking operation or of his failure to report inaccuracies. If the Owner is required to make further studies, redesign, or both, all expenses incurred by the Owner due to such inaccuracies will be deducted from any monies due the Contractor.
- H. The Contractor shall furnish all necessary personnel, engineering equipment and supplies, materials, and transportation incidental to the accurate and satisfactory completion of this work. There will be no direct payment for construction staking, or layout, but the cost thereof shall be considered as included in the bid unit prices or the Bid.
- I. The Contractor shall verify dimensions and utility locations shown on the Contract Drawing and if any inconsistencies or discrepancies should be noted on the Contract Drawings, or between the Contract Drawings and actual field conditions, or between the Contract Drawings and the Specifications, he shall immediately notify the Owner. The Contractor will be held responsible for any errors resulting from his failure to exercise the aforementioned precaution.

1.12 DIMENSIONS OF EXISTING STRUCTURES

- A. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

1.13 PRECAUTIONS DURING ADVERSE WEATHER

- A. During adverse weather and against the possibility thereof, the Contractor shall take all necessary precautions so that the work may be properly done and be satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building-paper shelters, or other suitable means.
- B. During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging or drying will result. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will be warm throughout when used.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 COORDINATION PROCEDURE

- A. The Contractor shall confer and verify with other contractors as to locations and extent of their work, to the end that interferences and deletions between trades are prevented and embedded or required items are installed in conjunction with the work under this contract.
- B. Project related interconnections to work provided by other contracts shall be made by the contractor whose work is erected last unless otherwise specifically stated in the Contract Documents, required by the Engineer, or as approved by the Owner/Engineer as necessitated by the nature or extent of the work. Unless specifically identified otherwise, any interconnects of new work to unrelated project components, whether existing or being installed by a third party shall still be the responsibility of this project's contractor that is responsible for the installation of the project work in question.
- C. The General Contractor shall be responsible for overall coordination of the construction work.

3.02 CLEAN UP AND RESTORATION

- A. Unless specifically addressed elsewhere, the following shall be considered minimum requirements:
 - 1. Restore all areas disturbed by construction to original condition or as defined by the Contract Documents if different.
 - 2. Provide continuous dust control during construction.
 - 3. The Contractor shall safely and professionally maintain their area(s) of work. If clean-up is not complied with, 10% of the succeeding progress payments, in addition to the normal contract retainage, will be withheld from the responsible Contractor until such clean-up is performed.

3.03 CUTTING AND PATCHING RESPONSIBILITIES

- A. The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

- B. The Contractor shall be responsible for cutting and patching required in existing areas during the execution of his work, except the General Contractor shall be responsible for all cutting and patching of existing roof structure and roofing.
- C. The Contractor shall at all times protect existing facilities and any work being performed by others from damage.
- D. The Contractor shall not cut or otherwise alter such construction by separate Contractors or by the Owner's own forces except with written consent of the Engineer, and appropriate coordination with third parties.
- E. The Contractor shall not unreasonably withhold, from the separate Contractors or the Owner, the Contractor's consent to cutting or otherwise altering the Work.
- F. Final finish of cut and patch areas (i.e. painting, flooring, etc.) shall be performed by General Contractor, except for areas of the existing buildings in which the General Contractor is not performing work of any kind. In areas of cut and patch work in which the General Contractor has no responsibilities, the HVAC/Electrical/Plumbing Contractor performing cut and patch shall be responsible for restoring final finish.
- G. In areas of cut and patch in which the General Contractor is providing final finish, Contractor performing cut and patch shall be responsible completing all necessary patch work to receive final finish (i.e. flashing, patching concrete, tape and finish gypsum wallboard, etc.) subject to acceptance of Engineer and General Contractor.

END OF SECTION

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION

- A. The work covered under this contract will be performed on Chester Brook in Waltham, MA. The specific location of work is adjacent to Lexington St, between the cross streets of Bishop Forest Dr and the access drive to the YMCA at 725 Lexington St. Access to the project site is via the access drive to the YMCA at 725 Lexington St.

1.02 SUMMARY

- A. The work to be performed under this contract includes:
1. Installation of construction erosion and sediment controls;
 2. Vegetation clearing and grubbing;
 3. The demolition of the existing outlet structure;
 4. Installation of replacement outlet structure;
 5. Installation of slide gate to existing outlet structure;
 6. Instalation of elevated walkway for viewing and maintenance access of the replacement outlet structure.
- B. In addition, work under the Contract includes:
1. The restoration of any items damaged or destroyed by encroaching upon areas outside the Project Site;
 2. Providing and restoring, where appropriate, all temporary facilities;
 3. Coordination with other projects being undertaken by the City and private utilities in the Project Site;
 4. All work either shown on the drawings or included in the specification unless specifically indicated as not to be done;
 5. Please note that the City, MWRA, and private utility companies have active and/or planned construction activities within close proximity to the Project Site. Coordination with other construction projects may be required.

1.03 TIME OF COMPLETION

- A. In accordance with the General Conditions, the work shall start as stated in the Notice to Proceed and al items related to construction and cleanup shall be completed withing 60 calendar days. Contractor shall be responsible for seed establishment per 02910 Establishment of Growth.

END OF SECTION

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Payment for the various Items of the Bid, as further specified herein, shall include all compensation to be received by the CONTRACTOR for providing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the items of work being described, as necessary to complete the various items of the WORK all in accordance with the requirements of the Contract Documents. Work also includes all costs of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the State of Ohio and the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid, and all costs therefore shall be included in the prices named in the Bid for the various Items of work.
- B. Payment for each respective item shall include such general costs for the providing of drawings, submittals, samples, tools and appliances necessary to complete the work as specified and shown on the Contract Drawings.

1.02 SCHEDULE OF VALUES

- A. The Contractor shall submit a detailed Schedule of Values for the Work of the Contract, including quantities and unit prices aggregating the Lump Sum Contract Price and submit for approval.
- B. If any unit price in the approved Schedule of Values requires that the said unit price cover and be considered compensation for certain work or material essential to the item, this same work or material will not also be measured or paid for under any other pay item which may appear elsewhere in the Specifications.
 - 1. Schedule shall be listed in tabular form and include the following:
 - a. Schedule item numbers.
 - b. Schedule item descriptions.
 - c. Unit cost description, bid quantity, bid unit cost, bid total amount per item.
 - d. Estimated quantities for previous period, current application period, and total to date per item.
 - e. Amount previously billed, amount billed this period, total amount billed and percent completion per item.
 - 2. Include a proportional amount of CONTRACTOR's overhead and profit for each item.
 - 3. If progress payments will be requested for materials or equipment stored either on or off site, show the following:
 - a. Cost of the materials, delivered and unloaded, with taxes paid.
 - b. Total installed value.
 - c. Upon request, submit documentation to support the values assigned to the Work. Sum of all values shall equal the TOTAL BID.
 - d. Schedule will be reviewed by the Engineer.

- 1) Upon approval by the Engineer, the schedule will become the official reporting form upon which Application Payment will be calculated.
- 2) Provide additional breakdown of bid item costs if requested by the Engineer.
- 3) Failure to submit this schedule or receive approval may result in withholding of approval of Application for Payment.

1.03 SUBMITTALS

A. Format and Contents

1. CONTRACTOR shall submit Application for Payment in accordance with General Terms and Conditions and as specified herein.
2. Application for Payment shall be made electronically on forms and spreadsheets provided by the OWNER.

1.04 DELIVERY, STORAGE AND HANDLING

- A. The CONTRACTOR shall make his own arrangements for delivery and handling of equipment and materials as it may require for the prosecution of the WORK. The location of all temporary roadways and similar facilities shall be subject to the approval of the OWNER and these shall be located and operated so as not to interfere with other work carried on by the OWNER, by other contractors, or by municipalities.
- B. The OWNER shall be provided each day with itemized delivery lists of the materials and equipment delivered to the site which are intended to be incorporated into the WORK. Any materials or equipment delivered to the site without prior approval of the OWNER will be at the sole risk of the CONTRACTOR and will be subject to rejection and removal. No WORK shall be done, or material or equipment installed until such is fully approved, and no unapproved work, materials or equipment will be included in any estimate for payment. Before any materials or equipment on hand are included in any estimate for payment, the CONTRACTOR must provide the OWNER an invoice or statement as to the cost of such.
- C. The CONTRACTOR shall make all necessary arrangements and provisions for the storage of materials and equipment to be used on this Contract. All excavated materials, construction equipment, and materials and equipment to be incorporated into the WORK shall be placed so as not to injure any part of the WORK or existing facilities and so that free access can be had at all times to all parts of the WORK and to all public utility installations in the vicinity of the WORK. Materials and equipment shall be kept neatly piled and compactly stored in such locations as will cause the minimum of inconvenience to public travel and adjoining property. Site area available on the construction site for storage of material and equipment shall be as shown on the Drawings.
- D. Material which are to become the property of the OWNER shall be so stored as to facilitate their inspection and ensure preservation of their quality and fitness, including proper protection against damage by freezing and wet weather; and they shall be placed under cover on wooden platforms or other hard, clean surfaces, and not on the ground.
- E. Equipment shall be stored in strict accordance with the manufacturer's recommendations and shall be stored in a climate-controlled building or enclosure if so recommended.

- F. Lawns and/or other private property shall not be used for storage purposes without written permission of the OWNER, its agent or other person in possession or control of such premises.
- G. When a pay estimate is allowed on account of material delivered to the site or in the vicinity thereof or under the possession and control of the CONTRACTOR but not yet incorporated therein, such materials shall become the property of the OWNER. If such material is stolen, destroyed or damaged by casualty before being used, the CONTRACTOR will be required to replace it at its own expense without further cost to the OWNER.

1.05 PAYMENT ITEMS

A. BID ITEM NO. 1 MOBILIZATION AND DEMOBILIZATION

1. MEASUREMENT

- e. The LUMP SUM price for Bid Item No. 1 shall constitute full compensation for furnishing at the project site, developing the schedule of values, as-built drawings, traffic control, and all people and equipment necessary to properly commence and complete the various sections of work described in the bid. It also includes any necessary construction permits and licenses required. Mobilization costs are those costs incurred in initiating the contract and providing for the above-mentioned equipment and labor to be operational at the site, exclusive of the cost of materials. For purposes of this contract, operational shall mean the substantial commencement of work. The lump sum price of this work shall not exceed five percent (5%) of the total bid amount. Bids not in compliance with the above may be considered unresponsive and may be rejected for that reason.
- f. Mobilization may be considered as complete by the Engineer when the Contractor substantially commences work on the project with a full complement of people and equipment necessary to perform and complete the required work. The Engineer may authorize a percent (%) complete of this Item for payment if all of the mobilization has not been accomplished. A breakdown of the lump sum price must be submitted to the Engineer.
- g. The lump sum price for mobilization shall include coordinating a location for staging and storing stockpiled materials including private agreements and fees that may be associated. The City of Waltham is not responsible to provide or coordinate.

2. PAYMENT

- a. Payment shall be LUMP SUM for inspection and monitoring performed and record documentation submitted and accepted based on the following breakdown:
 - 4) Pre-construction Inspection: 50% of Bid Item
 - 5) Post-construction Inspection: 50% of Bid Item

B. BID ITEM NO. 2 CLEARING, GRUBBING, AND STRIPPING

1. MEASUREMENT

- a. The UNIT PRICE per square foot stipulated for Bid Item No. 2 shall include the furnishing of all labor, materials, and equipment necessary to clear, grub, strip, remove trees, and remove stumps within the limits of disturbance, as detailed in the Contract Drawings and 02100 Site Clearing.

2. PAYMENT

G. BID ITEM NO. 7 FURNISH AND INSTALL YMCA ACCESS DRIVE WOODEN GAURDRAIL

1. MEASUREMENT

- a. The UNIT PRICE bid for Bid Item No. 7 shall include the furnishing of all labor, materials, and equipment necessary to furnish and install a wooden guardrail along the Northern side of the YMCA Access Drive per the contract drawings and 02485 Gaurdrails. The unit cost shall include the furnishing of all labor, materials, tools, and equipment necessary to perform the work.

2. PAYMENT

- b. The UNIT PRICE per square foot stipulated for Bid Item No. 7 shall include the furnishing of all labor, materials, and equipment necessary to install the wooden guardrail along the YMCA Access Drive as detailed in the Contract Drawings.

H. BID ITEM NO. 8 FURNISH AND INSTALL CONCRETE OUTLET STRUCTURE

1. MEASUREMENT

- a. The LUMP SUM bid for Bid Item No. 8 shall include the furnishing of all labor, materials, and equipment necessary to furnish and install the cast-in-place outlet structure per the Contract Drawings, 03050 Concrete, 03600 Grouting, 05050 Anchor Bolts, 07900 Joint Sealants, and 07905 Joint Fillers.

2. PAYMENT

- b. Payment of the LUMP SUM item will be paid based on the approved Schedule of Values for work completed in accordance with the Contract Documents.

I. BID ITEM NO. 9 FURNISH AND INSTALL STAINLESS STEEL SLIDE GATE

1. MEASUREMENT

- a. The LUMP SUM bid for Bid Item No. 9 shall include the furnishing of all labor, materials, and equipment necessary to furnish and install the stainless steel slide gate and gate connections on the front of the concrete outlet structure per the Contract Drawings, 03600 Grouting, 05050 Anchor Bolts, 11200 Stainless Steel Slide Gate.

2. PAYMENT

- b. Payment of the LUMP SUM item will be paid based on the approved Schedule of Values for work completed in accordance with the Contract Documents.

J. BID ITEM NO. 10 FURNISH AND INSTALL ELEVATED OBSERVATION AND MAINTENANCE WALKWAY

1. MEASUREMENT

- a. The LUMP SUM bid for Bid Item No. 10 shall include the furnishing of all labor, materials, and equipment necessary to furnish and install the foundation footers and prefabricated deck consisting of galvanized steel frame, composite decking, and composite handrails per the Contract Drawings, 02800 Modular Deck, and TO BE INSERTED GEOTECHNICAL SPECIFICATIONS FOR FOOTERS.

2. PAYMENT

- b. Payment of the LUMP SUM item will be paid based on the approved Schedule of Values for work completed in accordance with the Contract Documents.

K. BID ITEM NO. 11 FURNISH AND INSTALL RIPRAP

1. MEASUREMENT

- a. The UNIT PRICE bid for Bid Item No. 11 shall include the furnishing of all labor, materials, and equipment necessary to furnish and install the riprap protection device, and composite handrails per the Contract Drawings and 02274 Riprap.
- 2. PAYMENT
 - b. Payment of the UNIT PRICE per cubic yard stipulated for Bid Item No. 11 shall include the furnishing of all labor, materials, and equipment necessary to install riprap as detailed in the Contract Drawings.
- L. BID ITEM NO. 12 SITE RESTORATION
 - 1. MEASUREMENT
 - a. The LUMP SUM bid for Bid Item No. 12 shall include the furnishing of all labor, materials, and equipment necessary to restore the site by placing, loam, seed, and mulch per the Contract Drawings and 02910 Establishment of Growth.
 - 2. PAYMENT
 - b. Payment of the LUMP SUM item will be paid based on the approved Schedule of Values for work completed in accordance with the Contract Documents.
- M. BID ITEM NO. 13 UNIFORMED POLICE DETAIL ALLOWANCE
 - 1. MEASUREMENT
 - a. The ALLOWANCE amount stipulated for Bid Item No. 13 UNIFORMED POLICE DETAIL ALLOWANCE shall be \$5,000, to be used at the discretion of the OWNER for traffic control.
 - 2. PAYMENT
 - b. Payment of the ALLOWANCE item will be paid based on the approved Schedule of Values for work completed in accordance with the Contract Documents.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01300
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals.

1.02 ADMINISTRATIVE REQUIREMENTS

A. General:

1. Furnish submittal items as specified in the Contract Documents.
2. Review submittal information to verify it is accurate and fulfills specified submittal requirements before submitting for review and comment.
3. Edit submittal content to clearly indicate only those items, models, or series of equipment, which are being submitted for review. Cross out or otherwise obliterate extraneous materials.
4. Ensure there is no conflict with other submittals and notify the Owner's Representative in each case where the submittal may affect the work of another contractor or the Owner.
5. Coordinate submittals among subcontractors and suppliers including those submittals complying with unit responsibility requirements specified in the Contract Documents.
6. For each submittal, certify field conditions, compliance with the Contract Documents, and review of the submittal prior to submitting for review.
7. Designate the installation location within the project site, application, or intended purpose for each submittal item. Review comments are solely applicable to the circumstances designated in the submittal.
8. Coordinate submittals with the work so that work will not be delayed. Coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with others.
9. No extension of time will be allowed because of failure to properly schedule, coordinate or compile submittals.
10. Submittals will be rejected for lack of legibility, lack of coordination, ambiguity, or are incomplete. Incomplete submittals will be returned without review.
11. Do not proceed with work related to a submittal until the submittal process is complete. This requires that submittals for review and comment be returned to the Contractor stamped "No Exceptions Taken" or "Make Corrections Noted."
12. If desired, authorize material or equipment suppliers to deal directly with the Owner's Representative regarding a submittal. Such dealings require written authorization from the Contractor and are limited to contract interpretations to clarify and expedite the work.

B. Request for Substitution Procedures:

1. Requests for substitution for equipment specified by manufacturer or manufacturer's model number and listed below shall be in writing and shall be accompanied with sufficient information to permit the Construction Manager to identify the nature and

scope of the request. Information to be provided along with the request for substitution shall include:

2. All submittal information required for the specified equipment, including all deviations from the specified requirements necessitated by the proposed substitution.
3. Materials of construction, including material specifications and references.
4. Performance data, including performance curves and guaranteed power consumption, over the range of specified operating conditions.
5. Dimensional drawings, showing required access and clearances, including any changes to the work required to accommodate the proposed substitution.
6. Information and performance characteristics for all system components and ancillary devices to be furnished as a part of the proposed substitution.
7. Reproducible contract drawings, marked up to illustrate the alterations to all structural, architectural, and mechanical systems required to accommodate the proposed substitution.
8. A list of installations of the proposed substitution indicating application, location, owner and date of first use.

Upon receipt of written application for substitution from the Contractor, including the information specified above, the Construction Manager will estimate the cost of evaluating the request and present the estimate to the Contractor. The Contractor is advised that the estimate is based upon the best information available to the Construction Manager at the time; however, the actual cost, based on time and expense, will be documented and applied in the final analysis of the substitution request. If the Contractor wishes to proceed with the request, he shall advise the Construction Manager in writing and submit sufficient additional information as may be requested by the Construction Manager. No evaluation will take place until such time as the Contractor has agreed to the estimate in writing and has authorized the Construction Manager to deduct the cost of the evaluation from monthly progress payments due the Contractor.

1.03 DEFINITIONS

A. Action Submittals:

1. Action Submittals content require review and response by the Owner's Representative before proceeding with incorporating the subject equipment, materials, or procedure into the work.
2. Review comments on Action Submittals, and perform subsequent actions based on the REVIEW ACTION requirements specified below.

B. Informational Submittals:

1. Informational Submittals are examined to verify that the specified submittal contents have been furnished as specified.
2. The Contractor's actions are not contingent on the disposition of review comments on Informational Submittals.
3. Review comments on Informational Submittals, and perform subsequent actions based on the REVIEW ACTION requirements specified below.

C. Closeout Submittals:

1. Closeout Submittals consist of documentation that is not available for review at the time Action Submittals are submitted for review or documentation that is typically generated or furnished following incorporation of the equipment, materials, or procedure into the work. Closeout submittals include spare parts inventory listing, spare parts, extra stock materials, special tools and other materials or components that are furnished separate from the installed and completed work.
 2. Review comments on Closeout Submittals, and perform the subsequent actions based on the REVIEW ACTION requirements specified below.
- D. Samples:
1. Samples include partial sections of components, cuts, or containers of materials, color range sets, and swatches showing color, texture and pattern.
 2. Samples may be Action or Informational submittals.
- E. Mock-Ups:
1. Mock-ups are scale representations of items to be constructed as part of the work as required in the Contract Documents.
 2. Mock-ups are Action Submittals.
- F. Review Actions:
1. The following definitions and actions are associated with the REVIEW ACTIONS DEFINED below:
 - a. NO EXCEPTIONS TAKEN: If the review indicates that the material, equipment or work method complies with the Contract Documents, submittal will be marked "NO EXCEPTIONS TAKEN." Implement the work method or incorporate the material or equipment covered by the submittal.
 - b. MAKE CORRECTIONS NOTED: If the review indicates limited corrections are required, submittals will be marked "MAKE CORRECTIONS NOTED." Implement the work method or incorporate the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, provide a corrected copy.
 - c. AMEND AND RESUBMIT: If the review reveals that the submittal is insufficient or contains incorrect data, submittals will be marked "AMEND AND RESUBMIT." Do not undertake work until the submittal has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".
 - d. REJECTED - SEE REMARKS: If the review indicates that the material, equipment, or work method does not comply with Contract Documents, the submittal will be marked "REJECTED - SEE REMARKS." Do not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" except at your own risk.

1.04 MASTER SUBMITTAL LIST

- A. A minimum of five (5) business days following the Notice to Proceed, the Contractor will provide the Owner's Representative a Master Submittal List listing anticipated submittal requirements for the contract.

- B. Contractor shall update the list as submittals are completed and transmit to the Owner's Representative. Provide updated list to Owner's Representative monthly.
- C. Include the following as a minimum in the updated list:
 - 1. Submittal number.
 - 2. Date submitted.
 - 3. Requested time for return of comments.
 - 4. Special requests, if any, for that particular submittal.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUBMITTAL PROCEDURES

- A. General:
 - 1. Owner's Representative will review submittal information and indicate a REVIEW ACTION. Review of submittals does not relieve the Contractor of responsibility for performance of the work according to the Contract Documents.
 - 2. Coordinate submittal transmittal for related elements of work to ensure the submittals are processed as needed to meet the intent of the work and that delays are minimized.
 - 3. Submittal review activity will be prioritized based on the order received unless otherwise requested by the Contractor.
 - 4. A review duration of 15 calendar days is allotted for each submittal, from the date of receipt by the Owner's Representative to the date of return to the Contractor.
- B. Submittal Preparation:
 - 1. Excepting, mock-ups, spare parts, physical samples, and other items that cannot be converted to electronic media, furnish submittal contents electronically in a searchable PDF format.
 - a. Include a table of contents and labeled divider sheets that are coordinated with the table of contents.
 - b. Diagrams, drawings, pictures, and illustrations presented with a consistent orientation.
 - c. Action and Closeout Submittals: three (3) copies of submitted information plus one reproducible original.
 - d. Informational Submittals: three (3) copies of submitted information.
 - 2. Shop Drawings, Samples and Mock-ups
 - a. Submit one electronic copy per the requirements described above and the following:
 - 1) Shop Drawings: one (1) reproducible and three (3) prints for job site reference. One marked up print will be returned to the Contractor when the review is complete.
 - 2) Samples: three (3) samples
 - 3) Mock-up: As required by individual specification
 - 4) Demonstrations: As required to facilitate installation and inspection

- b. Reference applicable specifications for additional requirements
- C. Submittal Completeness:
 - 1. Submittals without all required information are not acceptable and may be marked "REJECTED" and returned without review.
 - 2. For a submittal to be deemed complete, provide the information required below and specified in specification sections, including those elements in the special transmittal procedures where required.
- D. In the event of the need to "revise and resubmit", provide a complete stand-alone submittal with corrections, revisions, and new information clearly identified.
- E. Resubmit changes to submittals that require a stamp and signature by a licensed engineer or other certification with the requisite stamp and signature or certifications.

3.02 TRANSMITTAL PROCEDURE

- A. General:
 - 1. Include the following information on the submittal transmittal form:
 - a. Project names and date.
 - b. Name of Contractor and Subcontractor
 - c. Name of supplier and name of manufacturer
 - d. Number and title of appropriate specification section
 - e. Drawing number and detail references, as appropriate
 - 2. Equipment and Material Submittals: Unless otherwise specified, complete the Transmittal Form - Submittal Transmittal Form specified in Section 01999 - Reference Forms.
 - 3. Operation and maintenance manuals, information and data Submittals: Complete the Transmittal Form - Operation and Maintenance Transmittal Form specified in Section 01999 - Reference Forms.
 - 4. Use a separate form for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which a submittal is required. Identify the appropriate equipment numbers for submittal documents common to more than one piece of equipment. Submit a single form for multiple items, if the items taken together constitute a Supplier's package or are functionally related, to facilitate checking or reviewing the group or package as a whole.
 - 5. Assign a unique sequential number to each transmittal form accompanying each item submitted.
 - a. Format submittal numbers as follows: "SS SS SS-XXX"; where "SS SS SS" is the referenced 6-digit section number from the Specifications and "XXX" is the sequential number assigned by the Contractor.
 - b. Format resubmittals as follows: "SS SS SS-XXX-YY"; where "XXX" is the originally assigned submittal number and "YY" is a sequential number assigned for resubmittals, i.e., 00, 01, or 02 being the original, 1st, and 2nd resubmittals, respectively. Submittal 43 23 50-001-02, for example, is the second resubmittal of submittal 001 pertaining to Section 43 23 50.
 - 6. Deviation from contract: If deviations from the material, equipment or method of work are proposed, describe the proposed deviation and explain the reason for

proposing the deviation under “deviations” on the transmittal form accompanying the submittal copies.

B. Check Marked Specification Transmittal Procedures:

1. When submittal requirements require a “marked” copy of the specification, provide a copy of the specification marked as indicated below. Provide the following when transmitting the submittal:
 - a. Provide a copy of the specification section(s) that specifies a marked copy of the specification. Include addendum updates and referenced specification sections, with addendum updates. Complete the following:
 - 1) Checkmark each paragraph to indicate submittal compliance with that specification requirement. Check marks (✓) shall denote full compliance with that paragraph as a whole.
 - 2) Mark paragraphs where deviations are proposed by underlining text that is the subject of the proposed deviation. Denoting each proposed deviation with a number in the margin to the right of the identified paragraph and provide a detailed written explanation for each numbered deviation. The remaining portions of the paragraph not underlined signify compliance with specified requirements.
 - 3) The Engineer is the final authority for determining acceptability of requested deviations.
 - b. For equipment specifications, provide a copy of the control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the subject equipment. Complete the following:
 - 1) Mark drawings or diagrams to show specific changes necessary for the equipment proposed in the submittal.
 - 2) If no changes are required, mark the drawings or diagrams with "no changes required".

C. Provide a Certificate of Unit Responsibility assigning unit responsibility in accordance with the requirements of the specification Section. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with the Specifications.

D. Samples and Mock-ups:

1. Submit samples and mock-ups in accordance with the Contract Documents. Package samples to facilitate review. Include the following with the Submittal Transmittal Form:
 - a. Generic description of the sample
 - b. Sample source
 - c. Product name and name of manufacturer
 - d. Compliance with recognized standards
 - e. Submittal Number
 - f. Availability and delivery time
 - g. Specification Section

2. Submit samples and mock-ups before installation. Where variation in color, pattern, texture or other characteristics are inherent in the material, submit four units to show variation range.
3. Where samples are for selection of appearance characteristics from a range of standard choices, submit a full set of choices for the material or products.
4. Maintain sets of approved samples and mock-ups at the Project Site, for quality comparisons throughout the course of construction.
5. Demolish and remove all samples and mock-ups prior to substantial completion.

3.03 REVIEW PROCEDURE

A. General:

1. Owner's Representative will review each submittal, indicate a REVIEW ACTION, and return to the Contractor.
2. Returned submittals indicate one of the following REVIEW ACTIONS: NO EXEMPTIONS TAKEN, MAKE CORRECTIONS NOTED, AMEND AND RESUBMIT, or REJECTED – SEE REMARKS.

3.04 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

A. General:

1. Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, does not relieve the Contractor of responsibility for errors therein and is not regarded as an assumption of risks or liability by the Owner's Representative or the Owner, or by any officer or employee thereof, and the Contractor has no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment reviewed. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" means that the Owner has no objection to the Contractor, upon his own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

END OF SECTION

SECTION 01400
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services, field inspections and field testing of civil and structural constructs required for this project.
- B. The Contractor is responsible for the quality assurance and quality control of their respective work for the construction of this project in accordance with the Contract Documents.

1.02 RELATED SECTIONS

- A. This section contains specific references to the following related section. Additional related sections may apply that are not specifically listed below.
 - 1. Section 01 45 23 Testing and Inspection Services

1.03 DEFINITIONS

- A. Quality Control System (QCS): The quality control, assurance, and inspection system established and carried out to ensure compliance with the Plans and specifications.
- B. QCS Supervisor: That person in responsible charge of the work occurring, as designated by the Contractor in the QCS Plan.
- C. QCS Inspector: Responsible, certified personnel inspecting the various constructs at specified milestones and during the project overall and designated by the Construction Manager.
- D. Factory Test: Tests made on various materials, products and component parts prior to shipment to the job site.
- E. Field Tests: Tests and analyses made at or in the vicinity of the job site in connection with the actual construction.
- F. Certified Inspection Report: Reports signed by approved inspectors attesting that the items inspected meet the specification requirements other than any exceptions included in the report.
- G. Certificate of Compliance: Certificate from the manufacturer of the material or equipment identifying said manufacturer, product and stating that the material or equipment meet specified standards, and shall be signed by a designated officer of the manufacturer.
- H. Standard Compliance: Condition whereby specified materials or equipment must conform to the standards of organizations such as the American National Standard

Institute (ANSI), American Society for Testing and Materials (ASTM), Underwriters Laboratories (UL) or similar organization.

- I. Quality Assurance: The day-to-day, in-process supervisory observations of work and materials conducted by the Contractor to assure that the proper methods and materials are being used and installed by tradesmen.
- J. Source Quality Control: The in-process testing and inspections conducted by the QCS Inspector(s) to verify that the materials, equipment; workmanship and shop manufactured constructs are in compliance with the Contract Documents, applicable Codes and standards.
- K. Field Quality Control: The testing and inspections conducted by the QCS Inspector(s) in the field during and at the completion of each construct to verify that the in-process and completed construction is in compliance with the Contract Documents, applicable Codes and standards.
- L. Special Inspector – A qualified individual employed or retained by an approved agency and approved by the local governing authorities having jurisdiction (AHJ) as having the competency necessary to inspect a particular type of construction requiring special inspection.

1.04 SUBMITTALS

- A. Action Submittals:
 - 1. Procedures: Section 01300.
 - 2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
 - 3. Check-marks (✓) denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance with the specification. Include a detailed, written justification for each deviation. Failure to include a copy of this marked-up specification section, along with justification(s) for requested deviations, with the submittal, is cause for rejection of the entire submittal with no further consideration.
 - 4. Written description of Contractor's proposed QCS plan in sufficient detail to illustrate adequate measures for verification and conformance to defined requirements. The QCS plan and submittal shall include a log showing anticipated inspections, QCS Inspectors, Special Inspections, and source and field Quality Assurance procedures. Submittal of the QCS plan shall be made prior to commencing field work.
 - 5. Contractor's proposed QCS Supervisor and QCS Inspectors (other than the Special Inspectors provided by Owner), including qualifications, responsibilities, and if requested, references.
 - 6. Complete structural system information describing Contractor designed structural systems, including sealed calculations, shop and erection drawings, product literature for the various components, International Code Council (ICC) Evaluation Reports for structural components, and a discussion of risk issues associated with the proposed system which could adversely impact overall project completion.

7. If requested by the Construction Manager during the work, manufacturer's field services and reports.
- A. Informational Submittals:
 1. Procedures: Section 01300.
 2. Manufacturers' field services and reports unless requested by Construction Manager to be submitted for review.
 3. Special Inspection reports, unless otherwise directed in each technical specification Section.

1.05 REGULATORY REQUIREMENTS

- A. GENERAL: Comply with all Federal, State, and local Codes as referenced herein. Such regulations apply to activities including, but not limited to, site work and zoning, building practices and quality, on and offsite disposal, safety, sanitation, nuisance, and environmental quality.
- B. SPECIAL INSPECTION: Special Inspection shall be performed by the Special Inspector under contract with the Owner or registered design professional in responsible charge acting as the Owner's agent in conformance with the IBC. Special Inspection is in addition to, but not replacing, other inspections and quality control requirements herein. Where sampling and testing required herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.
- C. STRUCTURAL OBSERVATION: Registered Design Professional shall make visual inspections of the work to assess general conformance with the Contract Documents at significant construction stages and at completion of the structural system in accordance with IBC 1704.6 Structural Observations requirements.

1.06 CONTRACTOR'S RESPONSIBILITIES

- A. Monitor quality assurance over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Coordinate with, schedule specified inspections by, and provide normal and customary assistance to the QCS Inspectors and Owner provided Special Inspectors.
- C. Coordinate with, schedule specified structural observations by Engineer, and provide normal and customary assistance to Engineer performing structural observations.
- D. Comply fully with manufacturers' instructions, including each step in sequence.
- E. Should manufacturers' instructions conflict with Contract Documents, request clarification before proceeding from Construction Manager.
- F. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

- G. The Contractor shall retain the services of a licensed land surveyor, registered in the State of Massachusetts, to perform survey work including but not limited to establishing line and grade, in advance of the construction; and to perform other surveying services for the work included under the Contract. The surveyor to be retained by the Contractor shall not be the same surveyor engaged for the Engineer's use. The surveyor shall be subject to the approval of the Engineer. Survey drawings shall be submitted to the Engineer for approval.
- H. The Contractor shall take all necessary measurements in the field to verify pertinent data and dimensions shown on the Drawings or to determine the exact dimensions of the Work.

1.07 FIELD SAMPLE PROCEDURES

- A. When field samples are specified in a unit of work, construct each field sample to include work of all trades required to complete the field sample prior to starting related field work. Field samples may be incorporated into the project after acceptance by Construction Manager. Remove unacceptable field samples when directed by Construction Manager. Acceptable samples represent a quality level for the work.

1.08 CONTRACTOR DESIGNED STRUCTURAL SYSTEMS

- A. DESIGN ENGINEERING: Contractor shall employ and pay for engineering services from a Professional Engineer registered in the State of Massachusetts for structural design of Contractor designed structural systems including but not limited to temporary shoring and bracing, formwork support, interior wall and ceiling systems, and support systems for fire sprinkler, plumbing, mechanical, and electrical systems and equipment.
- B. TESTS AND INSPECTIONS OF CONTRACTOR DESIGNED STRUCTURAL SYSTEMS: Contractor shall pay for preliminary testing of concrete, grout, and mortar mix designs where required by Code or these specifications prior to start of work. Contractor shall pay for required shop and site inspection of Contractor designed structural systems where required by Code or these specifications.

1.09 JOB SITE CONDITIONS

- A. Schedule to ensure all preparatory work has been accomplished prior to proceeding with current work. Proceeding with the work constitutes acceptance of conditions. Allow adequate time for materials susceptible to temperature and humidity to "stabilize" prior to installation. Establish and maintain environmental conditions (i.e., temperature, humidity, lighting) as recommended by the various material manufacturers for the duration of the work.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

- A. CONTRACTOR RESPONSIBILITIES: Provide source quality control according to the reviewed and accepted QCS plan and paragraph 1.06 herein. Coordinate with Construction Manager to facilitate the work of the Testing Laboratory specified in Section 01 45 23 and Special Inspector. Provide ready access to sampling and inspection

locations and incidental labor customary in such sampling and inspections. Timely prepare and submit submittals, and revise as indicated by review comments. Comply with technical requirements in each specification Section that applies to the work.

- B. **CONSTRUCTION MANAGER RESPONSIBILITIES:** Review Contractor's tracking of QCS activities at monthly meetings. Facilitate completion of submittal review per Section 01300. Assist Contractor to ensure that Special Inspection occurs where and when specified.
- C. **ACCEPTANCE CRITERIA:** Acceptable characteristics and quality of a particular item or construct is defined in that item's or construct's specification Section.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Field quality control responsibilities of the Contractor and Construction Manager are substantially the same as described in paragraph 2.01, with the exception that this work occurs primarily on the jobsite as the work progresses, and Special Inspection will occur more often than at the source.
- B. Acceptable characteristics and quality of a particular item or construct is defined in that item's or construct's specification Section.

3.02 REGULATORY COMPLIANCE – SPECIAL INSPECTIONS

- A. The types of work requiring Special Inspection are specified in the Construction Documents and required to obtain regulatory approval by State or required by local governing authorities having jurisdiction over the building permit of the project.
- B. A Contractor designed structural systems are subject to the same Special Inspection requirements as all other work.

3.03 CORRECTION OF DEFECTIVE WORK

- A. Any defective or imperfect Work, equipment, or materials furnished by the Contractor which is discovered before the Final Acceptance of the Work, or during a warranty period, shall be removed immediately even though it may have been overlooked by the Engineer and approved for payment. The Contractor shall repair such defect, without compensation, in a manner satisfactory to the Engineer.
- B. Unsuitable materials and equipment may be rejected, notwithstanding that such defective Work, materials and equipment may have been previously overlooked by the Engineer and accepted or approved for payment.
- C. If any workmanship, materials or equipment shall be rejected by the Engineer as unsuitable or not in conformity with the Specifications or Drawings, the Contractor shall promptly replace such materials and equipment with acceptable materials and equipment at no additional cost to Owner. Equipment or materials rejected by the Engineer shall be tagged as such and shall be immediately removed from the site.

- D. The Engineer may order tests of imperfect or damaged Work equipment, or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor, and the nature, tester, extent and supervision of the tests will be as determined by the Engineer. If the results of the tests indicate that the required functional capability of the Work, equipment, or material was not impaired, the Work, equipment or materials may be deemed acceptable, in the discretion of the Engineer. If the results of such tests reveal that the required functional capability of the questionable Work, equipment or materials has been impaired, then such Work, equipment or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect Work, equipment or material in lieu of performing the tests.

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the requirement for temporary facilities including:
 - 1. Provide temporary facilities for the proper completion of the Work as required and specified.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. A 117.1: Accessible and Usable Buildings and Facilities.
- B. American Society for Testing and Materials (ASTM):
 - 1. E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. E136: Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
- C. National Fire Protection Association (NFPA):
 - 1. 70: National Electrical Code.
 - 2. 241: Standard of Safeguarding Construction, Alteration, and Demolition Operations.
 - 3. 701: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.03 POWER

- A. The Contractor shall provide power for construction at the Site.
- B. Contractor shall make arrangements with the electrical utility and with the Owner for power takeoff points, voltage and phasing requirements, transformers and metering and shall pay the costs and fees arising therefrom.
- C. The Contractor shall provide the special connections required for his work.

1.04 TEMPORARY LIGHTING

- A. If Contractor intends to work at night, he shall provide and maintain lighting for his operations and those of his subcontractors to achieve:
 - 1. A minimum lighting level of 2 watt/sq. ft. for construction operations. 1 watt/sq. ft. lighting to exterior staging and storage areas after dark for security purposes.
 - 2. Contractor shall provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required, for his operations and those of his subcontractors.
- B. Contractor shall maintain lighting and provide routine repairs. Contractor is responsible to remove the temporary lighting when no longer required.

1.05 TELEPHONE

- A. The Contractor shall provide telephone service at his construction site office. Mobile-only telephone service is acceptable, provided the Contractor can demonstrate suitable signal reliability.

1.06 SANITARY FACILITIES

- A. The Contractor shall provide toilet and washup facilities for his work force at the Site.
- B. The facilities shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.
- C. Contents shall be removed and disposed of in satisfactory manner by Contractor at a minimum of weekly intervals.
- D. Contractor shall enforce sanitary regulations amongst employees and take precautions against infectious diseases as deemed necessary. Isolate infected employee(s) and arrange for immediate removal of such person(s) from site.

1.07 POTABLE WATER

- A. Contractor shall provide his own water source for his construction operations and those of his subcontractors.
- B. Contractor shall provide sufficient potable quality drinking water for workers at project site.

1.08 UTILITY WATER

- A. Contractor shall provide his own water source for his construction and testing operations and those of his subcontractors.
- B. Contractor shall provide sufficient quality utility water for operations at project site. Water need not be potable, but Contractor retains all responsibility for treatment and filtering as needed to satisfy testing and operating conditions.

1.09 SUBMITTALS

- A. Site Plan. Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire Safety Program. Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.10 QUALITY ASSURANCE

- A. Electric Service. Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

- B. Tests and Inspections. Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Temporary Use of Permanent Facilities. Engage an installer of each permanent service to assume responsibility for the operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance regardless of previously assigned responsibilities.
- D. During adverse weather and against the possibility thereof, take necessary precautions so that the Work may be properly completed and is satisfactory. When required, protection shall be provided by use of tarpaulins, wood, and building-paper shelters, or other suitable means.
- E. During cold weather preheat materials, if required, and keep sufficiently warm the materials and adjacent structure into which they are to be incorporated so that a proper bond will take place and a proper curing, aging, or drying will result. Artificially heat protected spaces by suitable means that will result in a moist or a dry atmosphere according to the requirements of the Work being protected. Sufficiently heat ingredients for concrete and mortar so the mixture will be warm throughout when used.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. Fire Extinguishers. Portable, UL rated with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Coordinate locations with Construction Manager and Owner.
- B. Provide each temporary facility ready for use when needed to avoid delay. Do not remove until the facilities are no longer needed or are replaced by the authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. General. Install temporary service or connect to existing service. Arrange with utility company, the Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage. Provide temporary utilities to remove effluent lawfully. Connect temporary sewers to the municipal system as directed by authorities having jurisdiction.
- C. Water Service. Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities. Provide temporary toilets, wash facilities, and drinking water for the use of construction personnel. Comply with the requirements of authorities having

- jurisdiction for the type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating. Provide temporary heating required by construction activities for the curing or drying of completed installations or for protecting the installed construction from the adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on the completed installations or elements being installed.
 - F. Electric Power Service. Provide electric power service and a distribution system of sufficient size, capacity, and power characteristics required for the construction operations.
 - G. Lighting. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - H. Provide the superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.03 SUPPORT FACILITIES INSTALLATION

- A. General. Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
 - 2. Maintain support facilities until Construction Manager schedules Substantial Completion inspection. Remove before Final Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Temporary Roads and Paved Areas. Construct and maintain temporary roads and paved areas adequate for construction operations in coordination with the Construction Manager. Provide dust control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Permanent Roads and Paved Areas. Locate temporary roads and paved areas in same location as permanent roads and paved areas to the extent practicable. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas.
 - 3. Recondition the base after temporary use including removing contaminated material, regrading, proof rolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot mix asphalt pavement until immediately before Substantial Completion. Repair hot mix asphalt base course pavement before installation of final course.

- D. Traffic Controls. Comply with the requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for firefighting equipment and access to fire hydrants.
- E. Parking. Provide temporary parking areas for construction personnel. Provide designated parking for the Construction Manager's onsite staff.
- F. Dewatering Facilities and Drains. Comply with requirements of authorities having jurisdiction. Maintain Site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- G. Waste Disposal Facilities. Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.
 - 1. The Contractor shall be responsible for providing dumpsters for the collection and disposal of waste and debris, except for hazardous or unsanitary waste materials which shall be handled by Contractor producing such waste.
 - 2. Location of dumpsters shall be proposed by the Contractor and approved by the Owner.
 - 3. Comply with NFPA 241 for removal of combustible materials.
 - 4. Hazardous materials shall be containerized for removal from site.
- H. Lifts and Hoists. Provide facilities necessary for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Temporary Stairs. Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities. Protect existing vegetation, equipment, structures, utilities, and other improvements at the Site and on adjacent properties except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Pest Control. Engage pest control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Final Completion. Perform control operations lawfully, using environmentally safe materials.
- C. Security Enclosure and Lockup. Coordinate additional security requirements with site security personnel.
- D. Barricades, Warning Signs, and Lights. Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

- E. Temporary Egress. Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- F. Temporary Enclosures. Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

3.05 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision. Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance. Maintain facilities in good operating condition until removal. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Termination and Removal. Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. The Owner reserves right to take possession of the Project identification signs.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period.

END OF SECTION

SECTION 01700
RESTORATION OF IMPROVEMENTS

PART 1 GENERAL

1.01 STRUCTURES

- A. The Contractor shall take all precautions necessary to protect the integrity and usefulness of all existing facilities. If necessary, the Contractor may, with the approval of the Owner and as specified in the Contract Documents, remove such existing structures, including curbs, gutters, pipelines and utility poles as may be necessary for the performance of the work, and shall rebuild the structures thus removed in as good a condition as found with the requirements specified. They shall also repair existing structures which may be damaged as a result of the work under this contract.

1.02 ROADS AND STREETS

- A. Unless otherwise specified, roads and streets in which the surface is removed, broken, or damaged, or in which the ground has caved or settled during the work under this contract, shall be resurfaced and brought to the original grade and section. Roadways used by the Contractor shall be cleaned and repaired. Before resurfacing material is placed, edges of pavements shall be trimmed back far enough to provide clean, solid, vertical faces, and shall be free of loose material. All paved surfaces shall be cut with a pavement saw. Rough cuts are not allowed. Repair work shall conform to the paving specifications.

1.03 CULTIVATED AREAS AND OTHER SURFACE IMPROVEMENTS

- A. Cultivated or planted areas and other surface improvements which are damaged by actions of the Contractor shall be restored as nearly as possible to their original condition. Restoration shall take place within 1 week or sooner as directed by the Engineer.
- B. Existing guard posts, barricades, and fences shall be protected and replaced if damaged.

1.04 PROTECTION OF EXISTING INSTALLATIONS

- A. The Contractor shall protect all existing operating facilities and structures from damages. However, if damage occurs, the Contractor shall immediately correct or replace existing equipment, controls, systems, structures, or facilities which are damaged in any way as a result of his operations.

END OF SECTION

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 DRAWINGS

- A. Record Documents refer to those documents maintained and annotated by the Contractor during construction and are defined as:
 - 1. A neatly and legibly marked set of Contract Drawings showing the final location of structures, appurtenances, and equipment;
 - 2. Additional documents such as schedules, lists, drawings, and diagrams included in the specifications;.
- B. Unless otherwise specified, record drawings shall be full size.

1.02 SUBMITTALS

- A. Action Submittals:
 - 1. Procedures: Section 01300.
 - 2. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph checkmarked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 USE DURING CONSTRUCTION

- A. Record Documents shall be maintained in a clean, dry, and legible condition.
- B. Record Documents shall not be used for construction purposes and shall be available for review by the Engineer during normal working hours at the Contractor's field office.

3.02 UPDATES

- A. Marking of the Record Documents shall be kept current and shall be done at the time the material and equipment are installed.

B. Annotations to the Record Documents shall be made with an erasable colored pencil conforming to the following color code:

1. Additions – Red
2. Deletions – Green
3. Comments – Blue
4. Dimensions – Graphite*

**Legibly mark to record actual depths, horizontal and vertical location of underground raceways, cables, and appurtenances referenced to permanent surface improvements.*

C. Monthly Review Meetings:

1. During the monthly project meetings, the Contractor and Engineer shall review the record documents.
2. At that time the Contractor and Engineer shall review the working set of record drawings and initial the accepted areas where everyone has agreed that the location, elevation and/or other construction modification is at the indicated final location.
3. At the conclusion of each meeting, the Contractor shall submit the up-to-date Record Drawings to the Engineer.

D. Underground Utilities:

1. Contractor shall provide digital photographs of underground piping and conduits, a fixed measurement on the record drawings, and/or GPS coordinates showing locations from buildings or structures prior to burying piping or electrical conduit.
2. Contractor shall note the depth of buried piping and electrical conduit.

3.03 SUBMISSION

A. At the completion of the work, prior to final payment, all record drawings shall be submitted to the Engineer.

END OF SECTION

SECTION 01999
REFERENCE FORMS

PART 1 FORMS

1.01 DESCRIPTION

- A. The forms listed below and included in this section are referenced from other sections of the project manual:

Form No.	Title
01 33 00-A	Submittal Transmittal Form
01 45 20-A	Equipment Test Report Form
01 78 23-A	Operation and Maintenance Transmittal Form
01 78 23-B	Equipment Record Form
01 78 23-C	Equipment Record Form
43 05 11-A	Manufacturer's Installation Certification Form

01 33 00-A. SUBMITTAL TRANSMITTAL FORM

Submittal Transmittal

Submittal Description:	Submittal No: ¹	Spec Section:
------------------------	----------------------------	---------------

	Routing	Sent	Received
Owner:	Contractor/CM		
Project:	CM/Engineer		
	Engineer/CM		
Contractor:	CM/Contractor		

We are sending you:

- Attached
- Under separate cover via _____
- Submittals for review and comment
- Product data for information only

Remarks: _____

Item	Copies	Date	Section No.	Description	Review action ^a	Reviewer initials	Review comments attached

^aNote: NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected
Attach additional sheets if necessary.

Contractor

Certify either a or b:

- a. We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).
- b. We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.	Deviation

Certified by: _____

Contractor's Signature: _____

¹See Section 0300, Submittal Procedure.

01 45 20-A. EQUIPMENT TEST REPORT FORM

NOTE: This example equipment test report is provided for the benefit of the Contractor and is not specific to any piece of equipment to be installed as a part of this project. The example is furnished as a means of illustrating the level of detail required for the preparation of equipment test report forms for this project.

City Of Sample

Example Water Treatment Plant
 Stage IV Expansion Project

ABC Construction Company, Inc., General Contractor
 XYZ Engineering, Inc., Construction Manager

Equipment Test Report

- Equipment Name: Sludge Pump 2
- Equipment Number: P25202
- Specification Ref: 11390
- Location: East Sedimentation Basin Gallery

	Contractor		Construction Manager	
	Verified	Date	Verified	Date
A. Preoperational Checklist				
1. Mechanical				
a. Lubrication				
b. Alignment				
c. Anchor bolts				
d. Seal water system operational				
e. Equipment rotates freely				
f. Safety guards				
g. Valves operational				
h. Hopper purge systems operational				
i. Sedimentation tank/hopper clean				
j. O&M manual information complete				
k. Manufacturer's installation certificate complete				
2. Electrical (circuit ring-out and high-pot tests)				
a. Circuits:				
1) Power to MCC 5				
2) Control to HOA				
3) Indicators at MCC:				
a) Red (running)				
b) Green (power)				
c) Amber (auto)				
4) Indicators at local control panel				
b. Wiring labels complete				
c. Nameplates:				
1) MCC				
2) Control station				
3) Control panel				

	Contractor		Construction Manager	
	Verified	Date	Verified	Date
d. Equipment bumped for rotation				
3. Piping Systems				
a. Cleaned and flushed:				
1) Suction				
2) Discharge				
b. Pressure tests				
c. Temporary piping screens in place				
4. Instrumentation and Controls				
a. Flowmeter FE2502F calibration				
1) Calibration Report No.				
b. Flow recorder FR2502G calibrated against transmitter				
c. VFD speed indicator calibrated against independent reference				
d. Discharge overpressure shutdown switch calibration				
e. Simulate discharge overpressure Shutdown				
B. Functional Tests				
1. Mechanical				
a. Motor operation temperature satisfactory				
b. Pump operating temperature satisfactory				
c. Unusual noise, etc?				
d. Pump operation: 75 gpm/50 psig				
(1) Measurement:				
(a) Flow:				
(b) Pressure:				
(c) Test gage number:				
e. Alignment hot				
f. Dowelled in				
g. Remarks:				
2. Electrical				
a. Local switch function:				
1) Runs in HAND				
2) No control power in OFF				
3) Timer control in AUTO				
b. Overpressure protection switch PS2502C functional in both HAND and AUTO				
c. Overpressure protection switch PS2502C set at 75 psig				
d. PLC 2500 set at 24-hour cycle, 25 min ON				
C. Operational Test				
1. 48-hour continuous test. Pump cycles as specified, indicators functional, controls functional, pump maintains capacity, overpressure protection remains functional, hour meter functional				

RECOMMENDED FOR BENEFICIAL OCCUPANCY:

Construction Manager	Date
----------------------	------

ACCEPTED FOR BENEFICIAL OCCUPANCY

Owner's Representative	Date
------------------------	------

01 78 23-A. OPERATION AND MAINTENANCE TRANSMITTAL FORM

Date:	Submittal No: ²
To:	Contract No:
	Spec. Section:
	Submittal Description:
Attention:	From:

Checklist	Contractor		Construction Manager	
	Satisfactory	N/A	Accept	Deficient
1. Table of contents				
2. Equipment record forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Start-up, shutdown, and postshutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance man-hours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks:

Contractor's Signature :

² See Section 0300, Submittal Procedure.

01 78 23-B. EQUIPMENT RECORD FORM

Equip Descrip		Equip Loc	
Equip No.	Shop Dwg No.	Date Inst	Cost
Mfgr		Mfgr Contact	
Mfgr Address			Phone
Vendor		Vendor Contact	
Vendor Address			Phone

Maintenance Requirements	D	W	M	Q	S	A	Hours

Lubricants: Recommended:

 Alternative:

Misc. Notes:

Recommended Spare Parts				Electrical Nameplate Data			
Part No	Quan	Part Name	Cost	Equip			
				Make			
				Serial No.		Id No.	
				Model No.		Frame No.	
				Hp	V	Amp	Hz
				Ph	Rpm	Sf	Duty
				Code	Insl. Cl	Des	Type
				Nema Des	C Amb	Temp Rise	Rating
				Misc.			
				Mechanical Nameplate Data			
				Equip			
				Make			
				Serial No.		Id No.	
				Model No.		Frame No.	
				Hp	Rpm	Cap	Size
				Tdh	Imp Sz	Belt No.	Cfm
				Psi	Assy No.	Case No.	
				Misc			

43 05 11-A. MANUFACTURER'S INSTALLATION CERTIFICATION FORM

Contract No: _____ Specification section: _____

Equipment name: _____

Contractor: _____

Manufacturer of equipment item: _____

The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as specified in the project manual, has been provided in accordance with the manufacturer's recommendations, and that the trial operation of the equipment item has been satisfactory.

Comments:

Manufacturer

Contractor

Signature of Authorized Representative

Signature of Authorized Representative

Date

Date

SECTION 02100

SITE CLEARING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Scope: This section specifies site preparation which consists of clearing, tree removal, grubbing, and demolition.
- B. Existing Conditions: The Contractor shall determine the actual condition of the site as it affects this portion of work.
- C. Protection: Site preparation shall not damage structures, landscaping or vegetation adjacent to the site. The Contractor shall repair, or replace any damaged property.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CLEARING AND GRUBBING

- A. Unless otherwise specified, the Contractor shall remove obstructions such as brush, trees, logs, stumps, roots, heavy sod, vegetation, rock, stones larger than 6 inches in any dimension, broken or old concrete and pavement, debris, and structures where the completion of the work require their removal.
- B. Material that is removed and is not to be incorporated in the work shall be disposed of off the site.

3.02 DEMOLITION AND REMOVAL

- A. Structures: Demolition and removal of structures consist of removal of abandoned superstructures, foundation walls, footings, slabs and any other structures. Excavations caused by existing foundations shall be cleared of waste, debris and loose soil, and refilled as specified.
- B. Pavement: When portions of asphalt pavements and concrete pads are to be removed and later construction is to be connected, edges shall be saw cut, on a neat line at right angles to the curb face.
- C. Salvage: The Owner has the right to salvage any items scheduled for removal. The Contractor shall notify the Construction Manager 5 days prior to any salvage or demolition work to determine the disposition of items to be removed. The Construction Manager will mark items to be salvaged. Such items shall be properly disconnected, removed from their foundations, cleaned, and stored at a location identified by the owner..

3.03 UTILITY INTERFERENCE

- A. Where existing utilities interfere with the prosecution of the work, the Contractor shall relocate them in accordance with the General Conditions of the Contract Documents.

END OF SECTION

SECTION 02200
EXCAVATION AND FILL

PART 1 GENERAL

1.01 DESCRIPTION

- A. Scope:
1. This section specifies earthwork which consists of excavation, filling, grading, and disposal of excess material.
- B. Definitions:
1. Compaction: The degree of compaction is specified as percent compaction. Maximum or relative densities refer to dry soil densities obtainable at optimum moisture content.
 2. Excavation Slope: Excavation slope shall be defined as an inclined surface formed by removing material from below existing grade.
 3. Embankment Slope: Embankment slope shall be defined as an inclined surface formed by placement of material above existing grade.

1.02 QUALITY ASSURANCE

- A. References:
1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM C136	Standard Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1556	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in. (457-mm) Drop
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3017	Test Method for Moisture Content of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth)

B. Tests:

1. The Construction Manager will take samples and perform moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these specifications. The Contractor shall remove surface material at locations designated by the Construction Manager and provide such assistance as necessary for sampling and testing. The Construction Manager may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these specifications. Payment for inspection trenches shall be as specified in the General Conditions of the Contract Documents.
2. Tests will be made by the Construction Manager in accordance with the following:

Test	Standard Procedure
Moisture content	ASTM D3017
Gradation	ASTM C136
Density in-place	ASTM D1556
Moisture-density relationships	ASTM D1557

1.03 SUBMITTALS

- A. Samples of fill materials to be used shall be submitted 2 weeks in advance of use. Samples shall consist of 0.5 cubic feet of each type of material.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Type A:

1. Type A material shall be a clean gravel-sand mixture free from organic matter and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
3/4 inch	100
3/8 inch	70-100
No. 4	55-100
No. 10	35-95
No. 20	20-80
No. 40	0-55
No. 100	0-2

B. Type B:

1. Type B material shall be a select granular material free from organic matter and of such size and gradation that the specified compaction can be readily attained. Material shall have a sand equivalent value determined in accordance with ASTM D2419 of not less than 20 and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
3 inch	100
No. 4	35-100

2. The coefficient of uniformity shall be 3 or greater.
3. The material may be an imported quarry waste, clean natural sand or gravel, select trench excavation or a mixture thereof.

C. Type C:

1. Type C material shall be unclassified material which is free from peat, wood, roots, bark, debris, garbage, rubbish or other extraneous material. The maximum size of stone shall not exceed 6 inches. If the material excavated from the site meets these requirements, it may be classified as Type C.

D. Type D:

1. Type D material shall be granular material commonly known as pea gravel and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1/4 inch	100
No. 8	0-5

E. Type E:

1. Type E material shall be crushed rock commonly known as drain rock and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1-1/2 inch	100
3/4 inch	30-75
1/2 inch	15-55
1/4 inch	0-5

2. Type E material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65

F. Type F:

1. Type F material shall be crushed rock and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1-1/2 inch	87-100
3/4 inch	45-90
No. 4	20-50
No. 30	6-29
No. 200	0-12

2. Type F material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65.

G. Type G:

1. Type G material shall be pervious backfill. Pervious backfill material shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
2 inch	100
No. 50	0-100
No. 100	0-8
No. 200	0-4

H. Type H:

1. Type H material shall be 6-inch riprap. Riprap shall be graded rock having a range of individual rock weights as follows:

Weight of stone	Percent smaller by weight
10 pounds	100
5 pounds	80-100
2 pounds	45-80
1 pound	15-45
1/2 pound	5-15
Below 1/2 pound	0-5

2. Specific gravity shall be between 2.5 and 2.82.

I. Type I:

1. Type I material shall be 12-inch riprap. Riprap shall be graded rock having a range of individual rock weights as follows:

Weight of stone	Percent smaller by weight
160 pounds	100
100 pounds	80-100
50 pounds	45-80
20 pounds	15-45
5 pounds	5-15
1 pound	0-5

2. Specific gravity shall be between 2.5 and 2.82.

J. Type J:

1. Type J material shall be unclassified material and may be obtained from excavation on site. The material may contain extraneous material such as demolition waste, unsuitable material excavated from beneath structures, and clearing and grubbing debris up to 50 percent by volume. Extraneous material shall be thoroughly mixed and the maximum size of organic particles shall be 6 inches.

PART 3 EXECUTION

3.01 GENERAL

A. Control of Water:

1. The Contractor shall keep excavations reasonably free from water during construction. The static water level shall be drawn down a minimum of 1 foot below the bottom of excavations to maintain the undisturbed state of natural soils and

allow the placement of any fill to the specified density. Disposal of water shall not damage property or create a public nuisance. The Contractor shall have on hand pumping equipment and machinery in good working condition for emergencies and shall have workmen available for its operation. Dewatering systems shall operate continuously until backfill has been completed to 1 foot above the normal static groundwater level.

2. Groundwater shall be controlled to prevent softening of the bottom of excavations, or formation of "quick" conditions. Dewatering systems shall not remove natural soils. The Contractor shall control surface runoff to prevent entry or collection of water in excavations.
3. Release of groundwater to its static level shall be controlled to prevent disturbance of the natural foundation soils or compacted fill and to prevent flotation or movement of structures or pipelines.

B. Overexcavation:

1. Where the undisturbed condition of natural soils is inadequate for support of the planned construction, the Construction Manager will direct the Contractor to overexcavate to adequate supporting soils. The excavated space shall be filled to the specified elevation with backfill. The overexcavated space under footings may be filled with concrete. The quantity and placement of such material will be paid for as extra work.

C. Surplus Material:

1. Unless otherwise specified, surplus excavated material shall be disposed of off site in accordance with applicable ordinances and environmental requirements.
2. If the quantity of surplus material is specified, the quantity specified is approximate. The Contractor shall satisfy himself that there is sufficient material available for the completion of the embankments before disposing of any material inside or outside the site. Shortage of material, caused by premature disposal of any material by the Contractor, shall be replaced by the Contractor.
3. Material shall not be stockpiled to a depth greater than 5 feet above finished grade within 25 feet of any excavation or structure except for those areas designated to be preconsolidated. For these areas, the depth of stockpiled material shall be as specified. The Contractor shall maintain stability of the soil adjacent to any excavation.

D. Borrow Material:

1. If the quantity of acceptable material from excavation is not sufficient to construct the embankments required by the work, the quantity of material needed to complete the embankments shall consist of imported borrow conforming to specified requirements.

E. Hauling:

1. When hauling is done over highways or city streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading. The loads shall be watered after trimming to eliminate dust.

F. Haul Roads:

1. The Contractor shall construct haul roads required to transport materials on site. Alignment of haul roads shall be selected to avoid interference with plant operations. Haul roads shall be removed after completion of embankment construction.

G. Finish Grading:

1. Finished surfaces shall be smooth, compacted and free from irregularities. The degree of finish shall be that normally obtainable with a blade-grader.
2. Finished grade shall be as specified by the contours plus or minus 0.10 foot except where a local change in elevation is required to match sidewalks, curbs, manholes and catch basins, or to ensure proper drainage. Allowance for topsoil and grass cover, and subbase and pavement thickness shall be made so that the specified thickness of topsoil can be applied to attain the finished grade.
3. When the work is an intermediate stage of completion, the lines and grades shall be as specified plus or minus 0.5 foot to provide adequate drainage.
4. If the soil is to be cultivated or straw is to be incorporated into the surface, rocks larger than 2-1/2 inches in maximum dimension, roots and other debris on the surface of the slope shall be removed and disposed of prior to cultivation or placement of straw.

H. Control Of Erosion:

1. The Contractor shall maintain earthwork surfaces true and smooth and protected from erosion. Where erosion occurs, the Contractor shall provide fill or shall excavate as necessary to return earthwork surfaces to the grade and finish specified.

3.02 CLASSIFICATION OF FILL

- A. Fill material shall be placed in horizontal layers and compacted with power-operated tampers, rollers, idlers, or vibratory equipment. Material type, maximum layer depth, relative compaction, and general application are specified in **Table A**. Unless otherwise specified, fill classes shall be used where specified in **Table A** under general application.

Table A, Fill Classifications

Fill class	Material type	Maximum uncompressed layer depth, inches	Minimum relative compaction, percent	General application
A1	A	8	95	Bedding for pipe, initial pipeline backfill; slabs on grade (other than specified for Class E1)
A2	A	48	95	Initial and subsequent pipeline backfill when ponded or jetted
B1	B	8	95	Structure and subsequent pipeline backfill
B2	B	8	90	Site fill
C1	C	8	90-95	Subsequent pipeline backfill; compaction as specified
C2	C	8	90	Site fill, embankments and dikes
D1	D	-	95	Bedding for tanks and pipe, initial and subsequent tank and pipeline backfill
E1 ^a	E	8	-	Fill under slabs for structures and tank slabs with pressure relief valves
F1 ^b	F	12	95	Structure backfill, pipeline bedding, initial and subsequent pipeline backfill

Table A, Fill Classifications

Fill class	Material type	Maximum uncompressed layer depth, inches	Minimum relative compaction, percent	General application
G1	G	8	95	Bedding for plastic pipe, initial and subsequent pipeline backfill
H1 ^c	H	-	-	Embankment slope face, channel slope face
I1 ^c	I	-	-	Embankment slope face, channel slope face
J1 ^d	J	8	90	Excess fill

a. Compaction of layers shall be accomplished in two passes of equipment with complete coverage across the width of the field.

b. Material shall not be used for bedding or initial backfill for plastic pipe.

c. Fill material shall be grouted as specified in paragraph 3.08.

d. Asphalt and concrete slabs from demolition may be placed at the bottom of the fill side by side to form a continuous pad. Clearing and grubbing is not required unless shrubs are taller than 3 feet. Mucking of the subgrade and keying or benching of adjoining embankments is not required.

3.03 EARTHWORK FOR STRUCTURES

A. Structure Excavation:

1. The bottom shall not be more than 0.15 foot above or below the lines and grades specified. If the elevation of structure excavation is not specified, the excavation shall be not more than 0.15 foot above or below the elevation specified for fill material below the structure. Slopes shall vary no more than 0.5 foot from specified grade unless the excavation is in rock where the maximum variation shall be 2 feet.
2. Should the excavation be carried below the lines and grades specified on the drawings or should the bottom of the excavation be disturbed because of the Contractor's operations and require overexcavation and backfill, the Contractor shall refill such excavated space to the proper elevation in accordance with the procedure specified for backfill. The cost of such work shall be borne by the Contractor.
3. Unless otherwise specified, excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete is specified to be placed directly against excavated surfaces.

B. Foundation Treatment:

1. Rock foundations for concrete or masonry footings shall be excavated to sound material. The rock shall be roughly leveled or cut to steps and shall be roughened. Seams in the rock shall be grouted under pressure as directed by the Construction Manager and paid for as extra work.
2. When footings are to be supported on piles, excavations shall be completed to the bottom of the footings before any piles are drilled or driven therein. When swell or subsidence results from driving piles, the Contractor shall excavate, or backfill the footing area to the grade of the bottom of the footing with suitable material as specified. If material under footings is such that it would mix into the concrete during footing placement or would not support the weight of the fluid concrete, the Contractor shall replace the material with suitable material, install soffit forms or otherwise provide a suitable platform on which to cast the footing as directed by the Construction Manager. This shall be paid for as extra work.

3. Whenever any structure excavation is substantially completed to grade, the Contractor shall notify the Construction Manager who will make an inspection of the foundation. No concrete or masonry shall be placed until the foundation has been inspected by the Construction Manager. The Contractor shall, if directed by the Construction Manager, dig test pits and make test borings and foundation bearing tests. If the material tested is undisturbed soil, the cost thereof will be paid for as extra work. If the material tested is backfill material, the cost thereof will be paid as specified in the General Conditions of the Contract Documents.

C. Structure Backfill:

1. Unless otherwise specified, structure backfill shall be Class B1.
2. After completion of construction below the elevation of the final grade, and prior to backfilling, forms shall be removed and the excavation shall be cleaned of debris.
3. Structure backfill shall not be placed until the subgrade portions of the structure have been inspected by the Construction Manager. No backfill material shall be deposited against concrete structures until the concrete has developed a strength of not less than 2500 pounds per square inch in compression, or until the concrete has been in place for 28 days, whichever occurs first.
4. Backfill material shall be placed in uniform layers and shall be brought up uniformly on all sides of the structure. When compaction is done by ponding and jetting, thickness of uncompacted layers shall not exceed 4 feet.
5. Compaction of structure backfill may be performed by ponding and jetting if the backfill material is of such character that it will be self-draining when compacted and that foundation materials will not be damaged by the applied water and no damage from hydrostatic pressure will result to the structure. Ponding and jetting shall not be used within 4 feet of finished grade and shall be performed in such a manner that water will not be impounded.
6. Unless otherwise specified, backfill around and above pipelines within the excavation line of any structure shall be the same as that specified for structures.

3.04 SUBGRADE FOR PAVEMENT

- A. The prepared subgrade shall be scarified to a depth of at least 12 inches and recompacted to at least 95 percent of the maximum density.

3.05 SITE FILL

- A. Unless otherwise specified, site fill shall be Class C2 fill. If the existing slope in an area to be filled is greater than 5:1, the Contractor shall bench the area prior to filling.

3.06 GROUTING RIPRAP

- A. When riprap is properly positioned, stones shall be flushed with water to remove fines, and cement grout as specified in Section 03600 shall be applied. Stones shall be wet prior to and during grout application. Grout shall be applied in two courses using baffles and diverting equipment. The first course shall completely penetrate the stone voids and shall be applied with the aid of poles or rods to loosen the tight pockets of stone. The second course shall be applied as soon as the first course has jelled. The second course shall be broomed uphill during application, and the entire surface shall be rebroomed to eliminate runs and fill voids.

- B. After grouting is complete, no load shall be permitted on the grouted surface for 24 hours. The grouted surface shall be protected from damage until curing is complete.

END OF SECTION

SECTION 02221
ROCK EXCAVATION AND DISPOSAL

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. Work under this section consists of furnishing all labor, tools, equipment and supervision necessary to excavate rock, if encountered, to the lines and grades required to install the structure as indicated on the Contract Drawings. The Contractor shall dispose of the excavated material for backfill in place of the excavated rock.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ROCK EXCAVATION

- A. "Rock" shall be classified as a material that requires for excavation drilling, blasting, or breaking by means of power tools. Boulders and concrete structures one cubic yard or greater, however removed, are included within this definition of rock. When material is encountered with respect to which the Contractor may claim removal as rock excavation, such material shall be uncovered and exposed and the Engineer notified by the Contractor before proceeding with the excavation. The Contractor shall not proceed with the excavation of the material to be removed as rock excavation until this material has been cross-sectioned and classified by the Engineer. Failure on the part of the Contractor to uncover such material, notify the Engineer, and allow time for cross sectioning the undisturbed surface of such material, will forfeit the Contractor's right of claim to any classification other than that allowed by the Engineer for the areas of work in which the deposits occur. Rock excavation shall be considered unsuitable backfill material and shall be used for ditch and slope protection or wasted off-site as directed by the Engineer.

3.02 EXCESS ROCK EXCAVATION

- A. If rock is excavated beyond the limits of payment indicated on the plans, and not specified or authorized in writing by the Engineer, the excess excavation, whether resulting from over breakage or other causes, shall be backfilled, by and at the expense of the Contractor, as specified below in this section.
- B. In excavations for structures, excess excavation in rock beneath foundations shall be filled with concrete that shall possess strength of 4,000 psi, or 3,000 psi, at the option of the Engineer. Under any foundation that over excavation has occurred, the entire area under the foundation shall be either all concrete or all backfill, but not both. Other excess excavation shall be filled with suitable backfill material

3.03 SHATTERED ROCK

- A. If the rock below normal depth is shattered due to drilling or blasting operations of the Contractor, and the Engineer considers such shattered rock to be unfit for foundations, the shattered rock shall be removed and the excavation shall be backfilled with concrete as required, except that in pipe trenches gravel fill may be used for backfill, if approved. All such removal and backfilling shall be done by and at the expense of the Contractor.

3.04 BACKFILLING ROCK EXCAVATIONS

- A. Where rock has been excavated and the excavation is to be backfilled, the backfilling above normal depth shall be done as specified under the related specifications. If material suitable for backfilling is not available in sufficient quantity from other excavation, The Contractor at his own expense, shall furnish suitable material from outside sources.

END OF SECTION

SECTION 02270
EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. This work shall consist of temporary and permanent control measures as shown on the Contract Drawings, as required, or as ordered by the Engineer throughout the construction and post-construction period to control erosion and sedimentation by the use of silt fences, sedimentation pools, check dams, filter fabric and other control devices. The erosion and sediment control features installed by the Contractor shall be satisfactorily maintained by the Contractor.
2. In the event that temporary erosion and sediment control measures are required due to the Contractor's negligence, carelessness or failure to install permanent controls as a part of the work scheduled, and such additional measures are ordered by the Engineer, the work shall be performed by the Contractor at his expense.
3. Repeated failures by the Contractor to control erosion (pollution/siltation) shall be cause for the Engineer to employ outside assistance or to use his own forces to provide the necessary corrective measures. The cost of such assistance plus Engineering costs will be charged to the Contractor and appropriate deductions made from the Contractor's monthly progress estimate.
4. The Contractor shall remove sediment from behind silt fences, check dams and from sedimentation pools as necessary or as directed by the Engineer.

1.02 REFERENCES

- A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
1. Section 01300 Submittal Procedures

PART 2 PRODUCTS

2.01 SLOPE PROTECTION AND EROSION CONTROL

- A. This work shall consist of the design, installation, maintenance and removal of temporary erosion control measures such as mulching slope drains and grasses to control and/or

event erosion around the construction site during construction. Mulches may be hay, straw, fiber mats, netting or other suitable material acceptable to the Engineer.

- B. Slope drains may be constructed of pipe, fiber mats, or other material acceptable to the Engineer that adequately controls erosion.
- C. Grass shall be a quick growing species (such as rye grass, Italian rye grass, or cereal grasses) suitable to the area providing a temporary cover which will not later compete with the grasses used later for permanent cover.
- D. Fertilizer and soil conditioners shall be a standard commercial grade acceptable to the Engineer.
- E. Hay bales shall be 36" x 18" x 24", or larger, with two 1" x 1" x 48" stakes, per bale, to secure the bale in place.

2.02 SEDIMENTATION POOLS

- A. Sedimentation pools where used shall be constructed to a size and configuration and at locations as approved by the Engineer. The sedimentation pools shall be constructed and operational before excavation, embankment or drainage system construction in the area served by the pool is started. A series of haybales, in a rectangle secured with oak stakes (see attached detail), line with siltation fence, and shall be used to construct a siltation pool. The discharge hose from the trench shall discharge into the pool. Sedimentation pools shall be maintained during and after construction in good hydraulic condition such that function as intended. Pools shall be maintained and kept in operation by the Contractor for the duration of the project. Sediment and other deposits shall be removed when the depth of material reaches 12 inches, or as directed by the Engineer, to ensure satisfactory pool performance. The Contractor shall provide and maintain access to the pools for their maintenance. The pools shall be removed at the completion of the Contract or when directed by the Engineer. All disturbed areas shall be covered with 4 inches of plantable soil borrow and seeded in accordance with the provisions of these Specifications

2.03 SILT FENCES

- A. This work shall consist of the construction, maintenance and removal of temporary silt fences. The silt fences shall be placed at the location shown on the Contract Drawings or as directed by the Engineer. The silt fences shall be in place before construction in the area begins.
- B. The snow fence should be set in place with a 6" trench on the front side. The filter fabric will be laid loosely on the fence so as not to stretch the material. The panels shall be overlapped a minimum of 12 inches. Suitable tie wire shall be used to secure the cloth to the top of the fence. The bottom of the cloth should be buried in the trench to prevent water from flowing beneath the fence. Fence posts shall be wooden or metal posts set 1 ½ feet into the ground at 6' centers.
- C. The filter fabric shall conform to the following requirements. The yarn shall consist by weight of at least 85 percent vinylidene chloride and shall contain stabilizers added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and/or heat exposure. After weaving, the cloth shall be calendered so that the filaments retain

their relative positions with respect to each other. The cloth shall be free of defects or flaws which significantly affect its physical and/or filtering properties. It shall be woven in widths of at least 6 feet and in rolls of not less than 50 linear feet. The sheets of filter cloth shall be sewn together with polypropylene or polyvinylidene chloride at the point of manufacture to form sections not less than 24 feet wide. All edges of the cloth shall be salvaged. During shipment and storage, cloth shall be wrapped with a suitable material for protection against damage.

- D. Should the Contractor desire to use an equal filter fabric sample of the proposed filter fabric shall be furnished 30 days prior to installation of the fabric. Samples, shipping, and cost of testing shall be at the Contractor's expense. A minimum of 5 square yards of cloth a minimum of 36 linear inches of seam, with at least one foot of cloth each side of the seam, shall be furnished for testing. Mill certificates, or affidavits from the manufacturer, shall accompany these samples, citing the trade name and producer of the cloth and certifying that the samples are representative of the material which will be installed on the project and that the cloth meets the requirements stated in this Specification. In addition, a certified copy of permeability and filtration tests from a qualified laboratory showing the performance of filter with various grain size soils and water, giving both particle retentions and permeability, shall be submitted at the request of the Engineer.
- E. Filter fabric shall be handled and placed in accordance with the manufacturer's recommendations. When the fabric is joined by stitching it shall be stitched with a yarn of contrasting color. The size and composition of the yarn shall be as recommended by the fabric manufacturer. The stitches shall number 5 to 7 per inch of seam.
- F. Should the fabric be damaged during placing, the torn or punctured section shall be repaired by placing a piece of fabric that is large enough to cover the damaged area and to meet the overlap requirement.
- G. Damaged sections of the silt fences shall be repaired or replaced by the Contractor for the duration of their use. Sediment shall be removed as directed by the Engineer.
- H. The silt fences shall be removed when adequate vegetative growth insures no further erosion of the slopes or when directed by the Engineer. The filter fabric may be cut at ground level.
- I. All material, including the filter fabric and fence, become the property of the Contractor and shall be disposed of away from the site.

2.04 STONE LINED WATERWAYS

- A. The Contractor shall provide all material, labor, and crushed stone for waterways, consisting of a protective covering of angular shaped stones laid on the waterway to insure protection of the waterway.
- B. The waterway shall be placed to line and grade as shown on the plans or as directed by the Engineer on a prepared bed of crushed stone. Each stone for the waterway shall be carefully placed by hand, normal to the slope and firmly bedded thereon. Each stone shall weigh not less than 50 pounds nor more than 125 pounds and at least 75% of the volume shall consist of stones weighing not less than 75 pounds each. The remainder of the stones shall be so graded that when placed with the larger stones, the entire mass

will be compacted with a minimum percentage of voids and a minimum thickness of 6 inches.

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. At the preconstruction conference or prior to the start of the applicable construction, the Contractor shall submit to the Engineer for acceptance, his plans and schedules for accomplishment of temporary and permanent slope protection and erosion control and restoration work, as are applicable for clearing and grubbing and general construction and disposal of unsuitable material and restoration of disturbed land to its original (prior to construction) condition. No work shall be started until schedules and methods of operations have been approved by the Engineer.

3.02 PROCEDURAL DETAILS

- A. The Engineer shall have the authority to limit the area of erodible earth exposed by construction and to direct the Contractor to provide immediate permanent or temporary erosion control and slope protection measures to prevent sediment runoff to adjacent streams, ponds, or other areas of water impoundment. Such work may involve the construction of temporary mulches, mats, seeding or other control devices or methods as required by the conduct of the work or as directed by the Engineer.
- B. The Contractor shall be required to incorporate all permanent erosion control measures into the project at the earliest practical time as outlined in the approved schedule. Temporary erosion control and slope protection measures will be used to correct conditions that develop during construction that were not foreseen during the design stage.
- C. The Contractor shall undertake and comply with the following measures with respect to adverse environmental impacts, resulting from the operations listed below.
 - 1. Clearing and Grubbing - Disturbed areas shall be re-grassed at the direction of the Engineer.
 - 2. Access Road Construction - Riprap or sodding shall be used to prevent erosion.
 - 3. Material Storage - Materials shall be stored only at approved locations. Petroleum products shall be stored away from wetland areas.
 - 4. Excavation - The Contractor shall use care to contain wet fill where it is dumped. When material is stockpiled next to a trench, the side away from neighboring brooks, swamps, canals, etc., shall be utilized where space is available. Side slopes of stockpiled material shall conform to the natural angle of repose of the soil. The Contractor shall promptly remove all sediment from brooks and swamp areas, if deposition cannot be avoided during construction. The Contractor shall promptly remove excess fill and re-grass the work area. Excess fill shall not be disposed of in wetlands, other than in areas defined on the drawings, or areas approved by commissions or authorities having jurisdiction.
 - 5. Water handling - The Contractor shall be required to use crushed stone or plastic sluiceways leading to brooks to filter pumped discharges.
 - 6. Backfilling - The Contractor shall replace unsuitable material with properly suitable material. He shall also be responsible for surface repairs as required.

7. General - Trash receptacles shall be required on the job site. The Contractor shall perform preliminary clean-up operations as he completes segments of his work.
8. Spillings - Ground spilling of oil or other petroleum products drained from equipment shall be prohibited. The Contractor shall provide leakproof containers for receiving drained oil and shall properly dispose of such oil away from the site of the job.

3.03 ACCEPTANCE

- A. Final inspection and acceptance in regard to cleanup, site restoration, erosion control and sloped protection measures shall be made in the presence of the Owner and/or commissions or authorities having jurisdiction. The Contractor shall notify the Owner in writing of the readiness of the work for final inspection.

END OF SECTION

SECTION 02274

RIPRAP

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. The Contractor shall furnish all labor, tools, materials, and equipment necessary to place riprap as indicated on the Contract Drawings and as herein specified. Following completion of the Contract, all riprap will become the property of the Contractor and will be removed from the site by the Contractor.

PART 2 PRODUCTS

2.01 RIPRAP

- A. Interlocking riprap shall be sound, durable rock. Each stone shall weigh not less than 55 pounds but not more than 120 pounds and at least 75% of the volume shall consist of stones weighing not less than 75 pounds each. The remainder of the stones shall be so graded that when placed with the larger stones the entire mass will be compact.
- B. Dumped riprap shall not be rounded stones or boulders unless authorized by special provisions. Stone shall be free from over-burden, spoil, shale, and organic material and shall meet the following gradation requirement specified.

Size of Stone	Maximum Percent of Total Weight Smaller than Given Size
400 lb	100
300 lb	80
200 lb	50
*25 lb	10

* No more than 5% by weight shall pass a 2" sieve.

- C. Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified. Stones smaller than the specified 10 percent size and spalls will not be permitted in an amount exceeding 10 percent by weight of each load.
- D. Control gradation will be by visual inspection. The Contractor shall provide at the locations specified a mass of rock of at least five tons meeting the gradation for the class specified. The sample at the construction site may be a part of the finished riprap covering. At the quarry, an additional sample shall be provided. These samples shall be used as a frequent reference for judging the gradation of the riprap supplied. Any difference of opinion between the Engineer and the Contractor shall be resolved by dumping and checking the gradation of two random truck loads of stone. Mechanical equipment, a sorting site and labor needed to assist in checking gradation shall be provided by the Contractor at no additional cost to the Owner.

- E. Riprap may be obtained from rock excavation being performed under the Contract if it conforms to the above requirements for size and quality.
- F. Rock shall be of such shape as to form a stable protective structure for the required sections. In general, riprap stone shall be angular in shape but rounded cobbles may be used on areas flatter than two horizontal to one vertical. Flat or needle shapes will not be accepted unless the thickness of the individual pieces is greater than one-third the length.

2.02 BACKING MATERIAL

- A. The backing material shall conform to all the above requirements and be well graded with in the following limits.

Backing A:

Size	Percent Finer Than
4 in	100
3 1/2"	80
3 in	50
3/4 in	10

Backing B:

Size	Percent Finer Than
1/2 in	100
3/8 in	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

PART 3 EXECUTION

3.01 PLACEMENT

- A. Riprap shall consist of a surface layer of large stones, resting on smaller stones where necessary to bring to the prescribed surface limits, and with all voids well filled with the largest practicable stones. Riprap may be placed by dumping, provided that the requirements of these specifications are met. If riprap is placed by dumping, it will be necessary to do additional work such as moving individual stones to ensure their stability and fill voids; the Contract shall do such additional work, as directed.
- B. Riprap shall be constructed on a staked geotextile fabric overlaid by a 12" base of Type 3 backfill overlaid by 811 of Backing B, overlaid by 8" of Backing A, overlaid by the riprap. Stones shall be carefully interlocked and laid with the flat surface at approximately right angles to the face of the slope or surface. The stones shall be so placed as to make a compact, stable, slope protection with a practicable minimum of surface voids.
- C. The largest stones in the surface layer shall have a minimum area in square feet measured on the face of the slope equal to the prescribed thickness of the riprap layer in

feet and a minimum thickness equal to one-third the prescribed thickness of the riprap layer. As many of these stones as possible shall have a thickness substantially equal to the full depth of the riprap.

- D. The surface of the riprap may be irregular within an upper tolerance line one-third the prescribed thickness of the riprap above, and a lower tolerance line one-fourth the prescribed thickness of the riprap below the prescribed upper limit of the riprap. The Contractor shall select and place a row of the largest available stones along the bottom edge of riprap.

END OF SECTION

SECTION 02401

DEWATERING

PART 1 GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all labor, materials, equipment, appurtenant material and equipment, and incidentals required to design, install, operate and remove a temporary dewatering system to prevent surface and groundwater from entering any excavations required as per this Contract. The dewatering system installed shall lower the groundwater and prevent surface water intrusion to provide a firm, dry excavation with a stable bottom and sidewalls capable of supporting structures, pipes and backfill.
- B. The Contractor shall retain the services of a Professional Geotechnical Engineer, registered in the State of Massachusetts and experienced in dewatering systems, to design the dewatering system to be used during construction. A copy of the proposed dewatering system including plans and calculations shall be submitted to the Engineer for review at least two weeks prior to commencing any work. All drawings and calculations shall bear the stamp and signature of the Registered Professional Geotechnical Engineer. The Registered Professional Geotechnical Engineer shall monitor the installation of the dewatering system and visit the site periodically during the construction period.
- C. The dewatering system shall include the installation of one or a combination of the following dewatering methods as necessary: sumps and ditches, horizontal drainage systems, cofferdam dewatering, well method, well point method, cutoff methods and other methods as designated by the Contractor's Geotechnical Engineer and approved by the Engineer.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. The bottom of all excavations shall be dry and firm. All excavation, construction, backfilling and compaction shall be conducted "in-the-dry" unless hydraulic compaction measures are dictated by the Engineer.
- B. The following measures shall be met in all areas where predrainage of the existing water table is required prior to construction operations.
 - 1. No excavation below the elevation of the groundwater level existing at the time of construction will be allowed until this groundwater level has been lowered to, and maintained at, an elevation at least 2 feet below the bottom of excavation.
 - 2. The dewatering system shall maintain the groundwater level at least 2 feet below the bottom of excavation until sufficient backfill has been placed to prevent flotation of any structures or pipelines.
 - 3. The Contractor and his Professional Geotechnical Engineer shall be responsible for insuring that dewatering measures and well points are so installed and situated as to provide sufficient dewatering of the work area and abutting soil stratum.
 - 4. The design of well points of other dewatering units shall be such that removal of fines during pumping is minimized.

- 5. A single stage well point system with the header at ground surface will not be adequate to lower the water level to the required depths.
- C. Safe working conditions shall be ensured by whatever dewatering measures deemed necessary, including the use of chemical and soil stabilization.
- D. During the course of construction if alterations or re-design of the dewatering system is necessitated, the Contractor's Professional Geotechnical Engineer shall submit plans and calculations, stamped and signed, indicating such alterations and changes. The Contractor shall bear all costs of the Geotechnical Engineer any modifications.
- E. Dewatering measures shall be so designed as to prevent the removal of any lines during pumping or excessive subsidence about the construction site. Discharged groundwater shall be properly detained, settled, filtered, or otherwise treated to prevent contamination, and to prevent contamination of nearby waterways.

1.03 SUBSURFACE CONDITIONS

- A. Test borings and groundwater observation wells installed along the excavation route by the Owner or Engineer shall be made available to the Contractor for their use.
- B. The Contractor shall also consider groundwater level fluctuations due to the season, precipitation, or other factors.
- C. The Contractor shall be responsible for obtaining all additional and supplementary information they deems necessary for the design of the dewatering system.

1.04 SUBMITTALS

- A. The Contractor shall submit to the Engineer for approval a plan showing a typical dewatering method to be used during the construction and in accordance with section 01300 submittal procedures. The plans shall be submitted to the Engineer four weeks prior to beginning the work. Plans shall show location of a given method and the materials to be used for a given installation. Submittal shall include a description of each piece of equipment to be used for the dewatering operation.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor shall conduct all dewatering operations in a manner, which will protect existing structures, pipelines and utilities from undermining of their bearing soils or disturbance to soil supporting, overlying or adjacent to structures. The Contractor shall be solely responsible for damage to properties, buildings, structures, utilities, pavements, sidewalks or pipelines resulting from his dewatering and surface water control operation.
- B. The Contractor shall control all surface and groundwater so that dry, firm, undisturbed bearing soils exist in the trench or pit during all stages of excavation, construction and backfilling. Softening and instability due to the presence of seepage of water shall not be allowed to occur.

- C. The Contractor shall maintain surface and groundwater control until backfilling is completed so as not to cause shifting of pipe due to flotation and buoyant forces.

3.02 CONCRETE STRUCTURES

- A. The Contractor shall construct concrete cutoff dams to prevent the unnatural flow of groundwater through the backfilled trenches as detailed on the Contract Drawings.
- B. The Contractor shall not permit water to rise above concrete or brick masonry within 24 hours after being placed, nor shall moving water be allowed to rise over any masonry for 96 hours. In no event shall water be permitted to rise to set up unequal pressures in structures until the concrete or mortar has set at least 24 hours.

3.03 SURFACE WATER CONTROL

- A. The Contractor shall control surface water inflow through the construction of dikes, ditches, pumps or any other control method required to prevent the flow of any surface water into any excavation.

3.04 INSTALLATION OF DEWATERING SYSTEM

- A. The Contractor shall install the dewatering system, and shall show to operate to the Engineer's satisfaction, prior to the excavation of any trench or pit. The system shall be shown to maintain the groundwater level as specified or modified to provide the required level as directed by the Engineer. Provisions shall be made to have standby pumps and generators available at all times.

3.05 OBSERVATION WELLS

- A. The Contractor shall install observation wells along the trench centerline in all areas requiring predrainage. There shall be an operating observation well located within 50 ft. of the working edge of the excavation. The Contractor shall install all observation wells to a minimum bottom of the excavation. Observation wells shall consist of a screened or slotted well point and a riser pipe shall be fitted with a threaded watertight cap. Additional observation wells may be required as instructed by the Engineer in areas where a sand stratum underlies a clay layer located at or below the bottom of the excavation.
- B. The Contractor shall make water level readings in the observation wells twice daily, and submit a copy to the Engineer on a daily basis. The Engineer shall be permitted to make independent readings as they require.

3.06 SITE RESTORATION

- A. Upon completion of the excavation work and approval of the Engineer, the Contractor shall restore the area to its pre-construction condition. All equipment, materials and accessories shall be removed and shall become the property of the Contractor. Observation wells shall be filled with sand upon completion of the Contract or as directed by the Engineer.

END OF SECTION

SECTION 02485

GAURDRAILS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. This section specifies the wooden guardrail shown on the Contract Drawings along the side of the YMCA Access Drive.

1.02 SUBMITTALS

- A. Submit shop drawings for wood guardrail, demonstrating compliance with this specification and 1300 Submittal Procedures.
- B. Submit certifications of wood type and grade.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored in a dry location, off the ground and in such a manner as to prevent damage, intrusion of foreign matter, vandalism and weather. All materials which have become damaged or otherwise unfit for the use during delivery or storage shall be replaced at the expense of the Contractor.
- B. The Contractor shall be responsible for timing and deliver of items to as to minimize onsite storage time prior to installation.

PART 2 PRODUCTS

2.01 WOOD GAURDRAIL

- A. Wood guardrail shall be dimensioned as shown in the contract drawings.
- B. Wood guardrail shall be constructed of solid ACQ pressure treated Southern Yellow Pine and planed to a smooth splinterless surface. Posts shall be rated for ground contact.
- C. All hardware shall be galvanized steel.
- D. Top beam of gaurdrall chall be fabricated to allow racking to smoothly align top rail with finished grade. End of rails shall be cut and alightned to fir together tightly at posts.

PART 3 EXECUTION

3.01 GENERAL

- A. Install and fasted materials and systems in proper relation with adjacent construction with uniform appearance. Wood gaurdrail shall be installed to smoothly align with the level or sloping finished grade. Postes shall be plumb. Align posts and rails in a consistent manner.

END OF SECTION

SECTION 02731
HANDLING OF EXISTING FLOWS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the measures and performance criteria necessary for diversion and care of water within Chester Brook for completion of the Work. Removal of all such temporary works after they have served their purpose is also included.
- B. Control water within and around Work areas within the ordinary high-water mark of Doan Brook to accomplish the following tasks:
 - 1. Excavation and removal of earth and debris.
 - 2. Construction of rock channel protection.
 - 3. Restoration of disturbed areas along the stream channel.
- C. Utilize a planned, phased approach to isolate work areas to complete Work within the ordinary high-water mark of the stream channel and avoid increasing the risk of adverse impacts to adjacent properties, infrastructure, and completed Work at all discharges.

1.02 GENERAL

- A. Contributing sources of discharge to Chester Brook include:
 - 1. Chester Brook upstream of Project Site.
- B. Discharges of contributing sources to the stream channel have not been directly measured. However, downstream locations have been measured and modeling results indicate baseflow is approximately 0.5 CFS and the approximate peak flow for a 10-year storm event is 320 CFS.

1.03 DEFINITIONS

- A. Cofferdam: A temporary water retention structure which separates the work area from Chester Brook. The area enclosed by the cofferdam is dewatered to permit completion of the required work in accordance with the Contract Documents.
- B. Diversion: Performance of all Work to divert discharge to and flow within Chester Brook around the work area.
- C. Dewatering: As defined in Section 02401, Dewatering.
- D. Ordinary High-Water Mark (OHWM): The line on the streambank established by the regular fluctuation of water, as shown on Contract Drawings.

1.04 GENERAL REQUIREMENTS

- A. Provide facilities and controls required to intercept, convey, and discharge the stream channel and piping discharges around the work sites; include standby and emergency equipment.
- B. All diverted water must be immediately returned to the stream channel at the downstream project limits so that sufficient flow of water is maintained at all times to sustain aquatic life downstream.
- C. Remove all vehicles and equipment from within the channel and floodbench of the stream channel when storm runoff is expected. Contractor will not be compensated for loss of vehicles or equipment left within the stream when storm runoff occurs.
- D. Contractor is solely responsible for selection, design, installation, cleanup, maintenance, and repair of diversion measures for all discharges within the construction period.
- E. The Contractor will be solely responsible and fully bear all costs, without compensation, for any cleanup, repairs, rework, or additional work that may be required due to inadequate stream diversion measures, cofferdams, dewatering and flood defenses, and for all delays associated with cofferdams and dewatering systems of inadequate capacity or design to accommodate floods or sequence of floods that occur during construction.
- F. Water control, cofferdam, and diversion designs shall incorporate appropriate freeboard above calculated water depths, and account for potential loads incurred by large debris such as floating logs.
- G. Protect water resources, wetlands, endangered species, and other natural resources.
- H. Temporary flow control shall be done in a manner that will not damage private or public property, or create a nuisance or public menace.
- I. Comply with all applicable Federal, State, and local regulations.
- J. Contractor will be solely responsible for all damage to property, buildings, infrastructure, and other improvements that result from the Contractor's Water Control Plan.

1.05 SUBMITTALS

- A. Informational Submittals:
 - 1. Water Control Plan.

1.06 WATER CONTROL PLAN

- A. Submit Water Control Plan at least 30 calendar days in advance of the start of work within the OHWM of the stream channel.
- B. Must be designed and sealed by a licensed professional engineer registered in Ohio, experienced in this type of work.

- C. At a minimum, the plan shall include:
1. Description of all activities that require diversion to complete the Work and a description of the overall approach to accomplish Work.
 2. Detailed schedule indicating the timing of all major phases and activities (demolition, clearing, excavation, fill and backfill, stabilization, etc.) associated with diversion and successful completion of Work within such areas.
 3. Proposed locations of stockpiled salvaged and excavated material, onsite spoil disposal areas, access roads, and/or staging areas for each major phase of Work.
 4. Design assumptions, including soil properties, hydrologic and hydraulic conditions, schedule, and other assumptions used in the design.
 5. Description of proposed diversion measures including, but not limited to, equipment, methods, fill placement, standby equipment and power supply, pollution control facilities, discharge locations to be utilized, and maintenance requirements during construction of the project.
 6. Contract Drawings showing locations, dimensions, sequencing, and relationships of elements of each system.
 7. Identification of hydrologic design criteria for proposed diversion including proposed discharge for which diversion measures will be sized.
 8. Design calculations demonstrating adequacy of proposed diversion systems and associated components.
 9. Design details showing design of cofferdam, access works, erosion protection, excavations, temporary dams, impervious or low permeability water barriers, types and sizes of all components and materials, gradation of backfill and fill soils proposed for temporary construction activities, methods of placement, types of equipment, capacity and reach, and access requirement near or within the stream channel.
 10. Anticipated impacts of proposed diversion facilities at discharges that exceed the discharge for which the diversion measures will be sized.
 11. Stream discharge monitoring plan.
 12. Plan for safe removal of personnel and equipment, in the event of discharges that exceed the discharge for which the diversion measures will be sized.
 13. Plan for assessment, cleanup, and repair for damage incurred by wet weather flows.
- D. If diversion measures are modified during installation or operation, revise, amend, and re-submit Water Control Plan.

1.07 SEQUENCING AND SCHEDULING

- A. The Work of this Specification shall not commence until Contractor's Water Control Plan have been approved by OWNER.
- B. Conceptual phasing for construction access, staging, and control of water shown on the Contract Drawings are to illustrate a potential phased approach to completion of the Work; however, all aspects of water control measures, including, but not limited to,

locations, sequencing, approach, materials and means and methods are the responsibility of the Contractor.

PART 2 PRODUCTS

2.01 COFFERDAMS

- A. Several elements of the work are anticipated to require construction behind a temporary cofferdam to divert surface water and permit construction in the dry. Potential cofferdam types include, but are not limited to:
 - 1. Pumping or gravity flow pipe for diversion around the work area.
 - 2. Gravel or sand filled bags (e.g. Supersacks, <http://www.bigbagsusa.com/>).
 - 3. Modular fabric cofferdams (e.g. Portadam, <http://www.portadam.com/>).
 - 4. Water Filled Bladders (e.g. Aquadam, <http://aquadam.net/>).
 - 5. Placement of clean temporary fill.
 - 6. Modular bin walls (e.g. Weekly Brothers Construction, <http://weeklybros.com/index.php?id=01>).
 - 7. Geomembrane-lined fill.
- B. Contractor may consider alternatives to cofferdams, such as, but not limited to, flow redirection measures, but Contractor is solely responsible to ensure such alternatives comply with required permits and regulations, including those pertaining to temporary fill and turbidity.

2.02 TEMPORARY FILL

- A. Stone, rock, or aggregate equal to or larger than ODOT No. 1 Rock. Contractor is solely responsible for selection of materials used in the diversion. Refer to Paragraph 1.04.D.

PART 3 EXECUTION

3.01 GENERAL

- A. Determine and implement means and methods for water diversion, cofferdams, and dewatering measures to control water during periods when necessary to accomplish Work.
- B. Temporary works shall be removed from the site at the completion of the project and become the property of the Contractor. If temporary works meet project fill requirements, Contractor may reuse the salvaged material.
- C. All equipment working within the stream corridor shall be clean and free of fluid leaks. Contractor shall have on hand, at all times, necessary items to arrest and contain leaks.

Hydraulic equipment shall use vegetable oil or other biodegradable fluid as an alternative to conventional hydraulic fluid.

- D. Comply with applicable Federal, State, and local regulations and permit requirements.
- E. Control turbidity during all phases of Work. Implement cofferdams, sediment curtains, diversion structures, or other means to comply with permit requirements.

3.02 DIVERSION MEASURES

- A. Select, design, and install diversion measures to meet needs and requirements for safe and successful completion of the Work, including hydraulics, safety, sliding and overturning stability, performance during overtopping, underseepage, uplift, scour, leakage, removal, potential to induce erosion, and others as applicable to the proposed cofferdam.
- B. Accommodate the natural flow variation, including discharges anticipated during the construction period and prolonged elevated flows.
- C. Diversion measure installation, maintenance, implementation, repair, and removal shall comply with applicable Federal, State, and local regulations and permit requirements.
- D. Water collected from within areas isolated from stream channel shall be treated and discharged as specified in Section 02401, Dewatering.

3.03 OVERTOPPING AND/OR FAILURE OF DIVERSION MEASURES

- A. In the event that cofferdams or other stream flow diversion measures fail or are overtopped by stream flows, Contractor shall be solely responsible for all delays, cleanup, repairs, materials, and other costs without additional compensation.
- B. Continuously perform Work and implement diversion measures to avoid increasing the risk of adverse impacts to adjacent properties and infrastructure and completed Work at all discharges.

3.04 DIVERSION OF WATER

- A. Divert water to facilitate completion of the Work. Assessment and selection of stream diversion measures, including use of existing diversion elements, shall be the sole responsibility of the Contractor. Stream diversion may include use of cofferdams, diversion channels, bypass pumping, and/or other means.
- B. Follow and comply with the approved Water Control Plan.
- C. Remove surface runoff controls when no longer needed.
- D. Contractor is responsible for ensuring human safety with work areas, including cofferdam enclosures, at all times.

3.05 DEWATERING

- A. Refer to Section 02401, Dewatering.
- B. Several components of the work shall be constructed in the dry, including, but not limited to, subgrade preparation, utility line improvements, and soil filling.

3.06 MONITORING WEATHER CONDITIONS

- A. Monitor weather forecasts, weather warnings, and climatic conditions which have the potential to influence the discharge of the stream channel. Take reasonable and prudent precautions to protect personnel, equipment, materials, temporary structures, completed Work, nearby infrastructure, and adjacent properties from imminent high discharges.

3.07 DISPOSAL OF WATER

- A. Obtain discharge permit for water disposal from authorities having jurisdiction.
- B. Discharge diverted water to the stream channel in accordance with permit requirements. Diverted water may be discharged directly to the stream channel, or water may be filtered by percolation into adjacent soils so long as the turbidity is not adversely impacted.
- C. Interpretation of regulations and permit requirements shall be the responsibility of the Contractor.
- D. Discharge water in manner that will not cause discharge of sediment, erosion, or flooding, or otherwise damage existing facilities, completed Work, or adjacent property. Use dewatering bag or other approved means to manage turbidity as necessary.
- E. Remove solids from diversion measures and perform other maintenance of diversion measures to maintain their efficiency.

3.08 PROTECTION OF PROPERTY

- A. Protect existing facilities, completed Work, and adjacent property vulnerable to settlement or damage from cofferdams, stream diversion, or dewatering operations.
- B. Cofferdams and stream diversion shall not damage retained or new structures. If damage occurs, Contractor shall solely and fully be responsible for repairs approved by OWNER.

END OF SECTION

SECTION 02800

PRE-FABRICATED STEEL FRAME WALKWAY

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. This section specifies the pre-fabricated steel frame walkway shown on the Contract Drawings. The pre-fabricated walkway shall be modular and include composite wood handrail, galvanized steel framing, and composite wood deck modules.

1.02 DESIGN LOADS

- A. Pedestrian live load: uniformly distributed 100 lbs per sq. ft
- B. Lateral wind load and uplift: 90 mph wind speed
- C. Maximum deflection: 1/360

1.03 SUBMITTALS

- A. Submit shop drawings for all walkway components, demonstrating compliance with this specification and 1300 Submittal Procedures.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored in a dry location, off the ground and in such a manner as to prevent damage, intrusion of foreign matter, vandalism and weather. All materials which have become damaged or otherwise unfit for the use during delivery or storage shall be replaced at the expense of the Contractor.
- B. The Contractor shall be responsible for timing and delivery of items to as to minimize onsite storage time prior to installation.

PART 2 PRODUCTS

2.01 MODULAR STEEL FRAME COMPONENTS

- A. Frames are to be fabricated with structural steel.
- B. Beam size and length are determined by vendor based on specific load requirements.
- C. Steel frame shall be welded prior to coating and be hot dipped galvanized.

1.05 MODULAR DECKING

- A. Board profile is determined by system load capacity.
- B. Decking material shall be composite.

- C. Decking shall arrive at installation site prefabricated.
- D. Deck modules shall match the size of the prefabricated frame.
- E. Deck to frame fasteners should be inserted in locations to prevent noise from vibration of deck when in used.

1.06 HANDRAILS

- A. Handrails shall be 36 inches in height.
- B. Handrail shall be constructed with two horizontal rails, one 18 inches above the surface of the deck and the second 36 inches above the surface of the decking.
- C. Handrail material shall be composite.

PART 3 EXECUTION

3.01 GENERAL

- A. Install and fasten modular frame and deck components and systems in proper relation with adjacent construction with uniform appearance. Postes shall be plumb. Deck and handrails shall be level.
- B. Deck shall provide access within 1 ft from the closest handrail to the hand operator of the stainless steel slide gate.

END OF SECTION

SECTION 02910
ESTABLISHMENT OF GROWTH

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. The Contractor shall furnish all labor, materials, and equipment necessary to do all loaming and seeding and planting, as indicated on the Contract Drawings and as herein specified.

PART 2 PRODUCTS

2.01 LOAM BORROW

- A. Loam borrow shall consist of a fertile, friable, natural topsoil typical of the locality, without admixture of subsoil, refuse or other foreign materials, and shall be obtained from a well-drained site. It shall be such a mixture of sand, silt and clay particles as to exhibit sandy and clayey properties in and about equal proportions. It shall be reasonably free of stumps, roots, heavy or stiff clay, stones larger than 1 inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter. Dumped riprap shall not be rounded stones or boulders unless authorized by special provisions. Stone shall be free from over-burden, spoil, shale, and organic material and shall meet the following gradation requirement specified.
- B. Prior to stripping, the loam shall have demonstrated by the occurrence upon it of healthy crops, grass or other vegetative growth that it is reasonably well drained and that it does not contain toxic amounts of either acid or alkaline elements.

2.02 TOPSOIL

- A. Topsoil shall consist of fertile, friable, natural topsoil, reasonably free of stumps, roots,
- B. Prior to stripping the topsoil from the construction project, it shall have demonstrated by the occurrence upon it of healthy crops, grass or other vegetative growth, that it is reasonably well drained and capable of supporting plant growth. Material classified as topsoil can only be obtained within the project limits. Riprap may be obtained from rock excavation being performed under the Contract if it conforms to the above requirements for size and quality.

2.03 LIMESTONE

- A. Limestone shall consist of pulverized limestone obtained by grinding either calcareous or dolomitic limestone so that 95% of the material will pass a no. 20 sieve and at least 50% of the material will pass a No. 100 sieve. The limestone shall have a neutralizing value satisfactory to the Engineer.

2.04 FERTILIZER

- A. Fertilizer shall be complete starter fertilizer, at least 70 percent of the nitrogen of which is derived from natural organic sources of ureaform. It shall contain the following percentages by weight: 15% nitrogen; 15% phosphorus; 15% potash.
- B. Fertilizer shall be delivered mixed as specified above, in standard size, unopened containers showing weight, analysis, and names of manufacturers. They shall be stored in a weatherproof storage place in such a manner that the fertilizer will be kept dry and its effectiveness shall not be impaired. Fertilizer shall be applied at a rate of 800 pounds per acre.

2.05 GRASS SEED

- A. Grass seed shall be of the previous year's crop and in no case shall the weed seed content exceed 1 percent by weight. The grass seed shall conform to the requirements of the following tables:

Grass Variety	Proportion	Germination Minimum	Purity Minimum
Baron Kentucky Bluegrass	50%	85%	98%
Creeping Red Fescue	20%	85%	98%
Yorktown Rye	15%	90%	98%
Jamestown Fescue	15%	90%	98%

2.06 PLANTING AND NURSERY STOCK

- A. Materials to be used in this work shall conform to "The American Standards of Nursery Stock" as sponsored by the American Association of Nurserymen, Inc. These standards shall determine all requirements of acceptable shrub and seeding nursery stock.
- B. All plants shall be packed so as to arrive at the delivery point in good growing conditions.
- C. Delivery of plants and seedlings shall be made to site, only according to the Contractor's ability to handle and properly care for them.
- D. All nursery stock shall be grown at nurseries in the northern area of the United States.
- E. All nursery stock shall conform to the "American Standards for Nursery Stock" as sponsored by the American Association of Nurserymen, Inc., U.S. Patent Office A60.1-1969.
- F. All plants shall be fully representative of their normal species or varieties unless otherwise specified. All plants must have a good, healthy, well-formed upper growth; a fibrous compact root system; and must be free from disease, injurious insects,

mechanical wounds either fresh or healed, broken branches, decay or any other defect; and shall be legible tagged with their proper names.

- G. All plant materials shall be dug with reasonable care and skill immediately previous to shipment. Special precautions shall be taken to avoid any unnecessary injury to or removal of fibrous roots. Each species or variety shall be handled and packed in the approved manner for that particular plant, having regard to the soil and climactic condition at the time and place of digging, transit and delivery, and to the time that will be consumed in transit. All precautions that are customary in good trade practice shall be taken to insure the arrival of the plants at the site of the project in good condition for successful growth.
- H. The roots of bare rooted material shall be carefully protected with wet straw, moss or other suitable material which will insure the arrival of the plants at the site of the work in good condition.

PART 3 EXECUTION

3.01 PLACEMENT OF LOAM OR TOPSOIL

- A. The loam or the topsoil obtained from stacked piles shall be hauled, deposited and spread to the directed depths on the areas shown on the plans or designated by the Engineer. The loam or topsoil shall be spread to a depth of not less than 4 in. All grass and weed growth on the areas designated to be loamed, shall be cut to a maximum height of 2 inches before the loam is placed thereon. After the loam or topsoil has been spread, it shall be carefully prepared by spading or harrowing, and lumps, large stones, brush, roots, stumps, litter and other foreign material shall be removed from the loamed, topsoil or processed planting materials areas and disposed satisfactorily.
- B. The compaction shall be equivalent to that produced by a hand roller weighing from 75 to 100 pounds per foot of width. The compaction may be obtained by rolling, dragging or any method that produces satisfactory results. All depressions caused by settlement or rolling shall be filled with additional materials and the surfaces shall be regraded and rolled until it presents a reasonably smooth and even finish and is up to the required grade.
- C. During hauling operations, the roadway surface shall be kept clean and any loam or other dirt which may be brought upon the surface shall be removed promptly and thoroughly before it becomes compacted by traffic. If necessary, the wheels of all vehicles used for hauling shall be cleaned frequently and kept clean to avoid bringing any dirt upon the surface. The Contractor shall take all reasonable precautions to avoid injury to existing or planted growth.

3.02 TOPSOIL REHANDLED AND SPREAD

- A. Topsoil which is obtained on the site, from piles of topsoil previously excavated and stacked and designated as topsoil to be re-handled and spread, shall be used as required, and as directed by the Engineer, on areas to be seeded. The topsoil must be approved before it is spread and the Contractor will be required, without compensation, to take corrective action as directed, in order to make the topsoil suitable for its intended use.

- B. The Contractor is required to adjust the acidity by the addition of limestone as determined by testing as required and to apply the fertilizer as required.

3.03 PREPARATION OF AREAS ON WHICH LOAM OR TOPSOIL IS TO BE PLACED

- A. The area upon which the above materials are to be placed shall be raked, harrowed or dragged to form a reasonably smooth surface, all stones larger than 2 inches, undesirable growth over 2 inches and debris shall be removed from the area and disposed of by the Contractor outside the location.
- B. When directed by the Engineer, additional suitable material shall be spread as required to repair gullies or depressions. The labor, equipment and materials necessary to place, compact and grade the additional material shall be paid for under the respective item from which the material is obtained.
- C. The Contractor shall not proceed with the work of seeding until permission of the Engineer has been obtained.
- D. Before the application of limestone, fertilizer and seed, the Contractor shall harrow or roto-till to a depth of 3 inches, when directed, all areas where loam or topsoil has been placed under a previous contract. When loam borrow is placed, or topsoil is re-handled and spread; and they are paid for under the respective items of a contract, they will not require harrowing or rototilling.
- E. The Contractor shall remove all debris and stones having any dimensions greater than 2 inches before the application of limestone, fertilizer and seed.

3.04 SURFACE DRAINAGE AND SEASONAL LIMITS

- A. The Contractor shall provide and maintain uniform grades, slopes, crowns and ditches on all excavations and fills to insure satisfactory drainage at all times during the construction period.
- B. The Contractor shall be responsible for protecting adjacent properties, completed work and work in progress from siltation and mud. Finished grades and surfaces for all work under this heading shall shed water to catch basins and outlet structures as per drawings.
- C. No fill material or topsoil shall be placed, spread or rolled during unfavorable weather conditions such as interruption by heavy rains. Fill operations shall not be resumed until approved by the Engineer.
- D. Seeding shall be performed during the growing season of the type of plant. No seeding shall be performed for the months of November through April.

3.05 ROUGH FINISHED GRADE

- A. Grading shall be accomplished as necessary to bring topsoil and sand surfaces to grades shown on the drawings or to prepare the subgrade to receive paving or construction as specified or shown on drawings.

- B. After completion of pavements and structures, surfaces of earth mounds and planting areas shall be rough finished graded and shaped by blading, dragging or other means. Surfaces shall be uniform and smooth, true to slopes and grades. Soils in plating areas shall be graded level with the edge of headerboards, pavement or walks. Particular attention shall be given to surface drainage around sump catch basins.
- C. The rough finished surface of the grading plane at any point shall not vary more than 0.10 feet above or below the grade indicated on the drawings.
- D. Upon completion of earthwork, the Contractor shall remove all surplus construction materials, earth and debris resulting from his work so that the entire job site is left in a neat and orderly condition.

3.06 APPLICATION OF LIMESTONE

- A. Limestone may be applied in dry form or hydraulically. Limestone where necessary shall be spread and thoroughly incorporated in the layer of loam or topsoil to adjust the acidity of the loam or topsoil. The rate of application of the limestone will vary up to a maximum of 1 pound per square yard depending on the results of laboratory tests performed by an independent professional testing laboratory acceptable to the Engineer, at the Contractor's own expense. The limestone shall be thoroughly incorporated into the layer of loam or topsoil and the upper 1-inch of the underlying subsoil by harrowing or other methods satisfactory to the Engineer so as to provide a layer of thoroughly mixed material for the seedbed.

3.07 APPLICATION OF FERTILIZER FOR GRASS

- A. Fertilizer may be applied in dry form or hydraulically. After the application in dry form or hydraulically and after the application of limestone, if found necessary, on the seed bed, starter fertilizer shall be spread on the top layer of loam or topsoil at the rate of 800 pounds per acre and worked into the seed bed. The full depth of loam or topsoil shall then be spaded or harrowed and graded to the required cross-section.

3.08 SEEDING

- A. After the loamed or topsoil areas have been prepared and treated as before described, grass seed conforming to the respective formulas before specified shall be carefully sown thereon at the rate of approximately 175 pounds per acre. Seeding shall be done in two directions at right angles to each other. Seeding on level areas and on slopes up to and including 4:1 slopes shall be done by means of an approved seeder that will seed and roll in one operation. On shoulders and other narrow areas, the seeding may be done longitudinally in one application.

3.09 SEEDING GRASS BY SPRAY MACHINE

- A. The spray machine will be restricted for use only on slopes steeper than 4:1. The application of limestone as necessary, fertilizer and grass seed may be accomplished in one operation by the use of limestone as necessary, fertilizer and grass seed may be accomplished in one operation by the use of an approved spraying machine. The materials shall be mixed with water in the machine and kept in an agitated state in order that the materials may be uniformly suspended in the water. The spraying equipment shall be so designed that when the solution is sprayed over an area the resulting

deposits of limestone, fertilizer and grass seed shall be equal in quantity to those quantities specified before.

- B. A certified statement shall be furnished, prior to start of work, to the Engineer by the Contractor as to the number of pounds of limestone, fertilizer, and grass seed, per 100 gal. of water.
- C. This statement should also specify the number of square yards of seeding that can be covered with the solution specified above. If the results of the spray operation are unsatisfactory, the Contractor will be required to abandon this method and to apply the limestone, fertilizer and seed as before specified.

3.10 CARE DURING CONSTRUCTION

- A. The Contractor shall be responsible for the watering of all seeded and grassed areas, which shall be kept moist. The Engineer's decision will prevail in the event a dispute develops with the Contractor as to whether or not the seeded and grassed areas are moist. Seeded areas on which growth has started shall be watered to a minimum depth of 2 inches to assure continuing growth. Watering shall be done in a manner which will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment to apply one complete coverage to the seeded areas in an 8 hour period.
- B. If necessary, suitable signs and barricades of brush or other materials shall be placed to protect the seeded areas. After the grass has appeared, all areas and parts of areas which fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded and such areas and parts of areas shall be seeded repeatedly until all areas are covered with a satisfactory growth of grass.
- C. The Contractor shall care for all of the seeded areas until the work has been accepted, without compensation in addition to the amount regularly to be paid under this item as hereinafter provided. Care shall include all regrading, refertilizing, reseeding and mowing which may be necessary.
- D. Contractor is responsible for care of seeded areas until growth has reached 3 inches.

3.11 REFERTILIZATION AND APPLICATION OF FERTILIZER

- A. This work shall be done in April, May, August or September. No permission will be granted to re-fertilize in months other than herein prescribed. Areas recently seeded shall be re-fertilized only after one season of growth of two months duration.
- B. The fertilizer shall have a composition of 10-10-10 and be applied at a rate of 500 pounds per acre. In addition, organic fertilizer derived from any commercial source shall be applied at the rate of 135 pounds of N per acre. Seed as before specified shall be included with the fertilizer at a rate of 10 pounds per acre.

3.12 PREPARATION FOR MULCHING

- A. The areas upon which mulch is to be spread shall be prepared by raking, harrowing or dragging to form a reasonably smooth surface. All stones larger than 2", undesirable growth over 2' in height and all debris shall be removed from the area and disposed by

the Contractor in a satisfactory manner. The disposal area shall be outside the location limits of the project, when required by the Engineer and shall be responsibility of the Contractor.

- B. When required by the Engineer, the Contractor shall spread, compact and grade additional acceptable material to repair gullies or depressions. Such additional material shall be obtained from suitable excavation or furnished by the Contractor.

3.13 PLACING MULCH

- A. Hay mulch shall be loosely spread to a uniform depth over all areas designated on the plans, at the rate of 4 ½ tons per acre. Hay mulch may be applied by mechanical apparatus, if in the judgement of the Engineer the apparatus spreads the mulch uniformly and forms a suitable mat to control slope erosion. The apparatus shall be capable of spreading at least 80% of the hay or straw in lengths of 6" or more, otherwise it shall be spread by hand.
- B. Wood chip mulch and aged pine bark mulch shall be loosely spread to uniform depth over all acres designated on the plans, at the rate of 390 cubic yards per acre (approximately 3" in depth), or as otherwise directed.
- C. Wood chip mulch and aged pine bark mulch may be applied by mechanical means, except that if the equipment breaks the mulch into small pieces or changes its desired texture, as determined by the Engineer, it shall be spread by hand.

END OF SECTION

SECTION 03050
CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete, reinforcing, and related materials.
 2. The Work includes:
 - a. Providing concrete consisting of portland cement, fine and coarse aggregates, water, and approved admixtures; combined, mixed, transported, placed, finished, and cured.
 - b. Fabricating and placing reinforcing, including ties and supports.
 - c. Design, erection, and removal of formwork.
 - d. Building into the concrete all sleeves, frames, anchorage devices, inserts, and other items required to be embedded in concrete.
 - e. Providing openings in concrete as required to accommodate Work under this and other Sections.
- B. Coordination:
1. Review installation procedures under other Sections and coordinate installation of items to be installed in the concrete Work.
- C. Classifications of Concrete:
1. Class A - shall be steel-reinforced and includes all concrete unless otherwise shown or indicated.
- D. Related Sections:
1. Section 05050, Anchor Bolts.
 2. Section 07900, Joint Sealants.

1.02 REFERENCES

- A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 224R	Control of Cracking in Concrete Structures
ACI 301	Specifications for Structural Concrete for Buildings
ACI 304R	Guide for Measuring, Mixing, Transporting and Placing Concrete
ACI 305R	Specification for Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 309R	Guide for Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete and Commentary
ACI 347	Guide to Formwork for Concrete
ACI SP-66	ACI Detailing Manual
ASTM A82/A82M	Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A185/A185M	Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615/A615M	Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C31/C31M	Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	Specification for Concrete Aggregates
ASTM C39/C39M	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94/C94M	Specification for Ready-Mixed Concrete
ASTM C138/C138M	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143/C143M	Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	Specification for Portland Cement
ASTM C172	Practice for Sampling Freshly Mixed Concrete
ASTM C231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494/C494M	Specification for Chemical Admixtures for Concrete
ASTM C579	Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
ASTM C1064/C1064M	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM D1752	Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM E96/E96M	Test Methods for Water Vapor Transmission of Materials
ASTM E154	Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
CRD-C 572	U. S. Army Corps of Engineers Specification for Polyvinylchloride Waterstops

1.03 QUALITY ASSURANCE

- A. Laboratory Trial Batch:
1. Employ independent testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
 2. Each concrete mix design specified shall be verified by laboratory trial batch, unless indicated otherwise.
 3. Perform the following testing on each trial batch:
 - a. Aggregate gradation for fine and coarse aggregates.
 - b. Slump.
 - c. Air content.
 - d. Compressive strength based on three cylinders each tested at seven days and at 28 days.
 4. Submit for each trial batch the following information:
 - a. Project identification name and number (if applicable).
 - b. Date of test report.
 - c. Complete identification of aggregate source of supply.
 - d. Tests of aggregates for compliance with the Contract Documents.
 - e. Scale weight of each aggregate.
 - f. Absorbed water in each aggregate.
 - g. Brand, type, and composition of cementitious materials.
 - h. Brand, type, and amount of each admixture.
 - i. Amounts of water used in trial mixes.
 - j. Proportions of each material per cubic yard.

- k. Gross weight and yield per cubic yard of trial mixtures.
- l. Measured slump.
- m. Measured air content.
- n. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28-day test, and for each design mix.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

- a. List of concrete materials and concrete mix designs proposed for use. Include results of tests performed to qualify the materials and to establish the mix designs. Do not start laboratory trial batch testing until this submittal is approved by ENGINEER.
- b. Laboratory Trial Batch Reports: Submit laboratory test reports for concrete cylinders, materials, and mix design tests.
- c. Concrete placement drawings showing the location and type of all joints.
- d. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI SP-66. For walls and masonry construction, provide elevations to a minimum scale of 1/4-inch to one foot. Show bar schedules, stirrup spacing, adhesive dowels, splice lengths, diagrams of bent bars, arrangements, and assemblies, as required for fabricating and placing concrete reinforcing.

2. Product Data:

- a. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.

3. Samples:

- a. Samples: Submit samples of materials as specified and as otherwise requested by ENGINEER, including names, sources, and descriptions.

B. Informational Submittals: Submit the following:

- 1. Delivery Tickets: Copies of all delivery tickets for each load of concrete delivered to or mixed at the Site. Each delivery tickets shall contain the

information in accordance with ASTM C94/C94M along with project identification name and number (if any), date, mix type, mix time, quantity and amount of water introduced.

2. Site Quality Control Submittals:
 - a. Report of testing results for testing of field concrete cylinders for each required time period. Submit within 24 hours after completion of associated test. Test report shall include results of all testing required at time of sampling.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transportation, Delivery, and Handling:
 1. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.
 2. Materials used for concrete shall be clean and free from foreign matter during transportation and handling and kept separate until measured and placed into concrete mixer.
 3. Implement suitable measures during hauling, piling, and handling to ensure that segregation of coarse and fine aggregate particles does not occur and grading is not affected.
 4. Deliver grout materials from manufacturers in unopened containers that bear intact manufacturer labeling.
- B. Storage:
 1. Store formwork materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective, waterproof covering. Provide for adequate air circulation or ventilation under cover.
 2. Store concrete reinforcing materials to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground. Space framework or blocking supports to prevent excessive deformation of stored materials.
 3. Store concrete joint materials on platforms or in enclosures or covered to prevent contact with ground and exposure to weather and direct sunlight.
 4. For storage of concrete materials, provide bins or platforms with hard, clean surfaces.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type II.

- B. Aggregates: ASTM C33/C33M.
 - 1. Fine Aggregate: Clean, sharp, natural sand free of loam, clay, lumps, and other deleterious substances. Dune sand, bank run sand, and manufactured sand are unacceptable.
 - 2. Coarse Aggregate:
 - a. Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter.
 - b. Coarse aggregate shall comply with the following:
 - 1) Crushed stone, processed from natural rock or stone.
 - 2) Washed gravel, either natural or crushed. Slag, pit gravel, and bank-run gravel are not allowed.
 - c. Coarse Aggregate Size: ASTM C33/C33M, Nos. 57 or 67, unless otherwise approved by ENGINEER.

- C. Water: Clean, potable.

- D. Admixtures:
 - 1. Air-Entraining Admixture: ASTM C260.
 - 2. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 3. Water Reducing and Set-Adjusting Admixtures: ASTM C494/C494M, Types D and E.
 - 4. High Range Water-Reducing Admixture: ASTM C494/C494M, Type F/G.
 - 5. Use only admixtures that have been tested and approved in the mix designs.
 - 6. Do not use calcium chloride or admixtures containing chloride ions.

2.02 CONCRETE MIX

- A. General:
 - 1. Normal weight: 145 pounds per cubic foot.
 - 2. Use air-entraining admixture in all concrete. Provide not less than four percent, nor more than eight percent, entrained air for concrete exposed to freezing and thawing, and provide from three to five percent entrained air for other concrete.

- B. Proportioning and Design of Class "A" Concrete Mix:
 - 1. Minimum compressive strength at 28 days: 4,500 psi.
 - 2. Maximum water-cement ratio by weight: 0.42.
 - 3. Minimum cement content: 564 pounds per cubic yard.

- C. Slump Limits:
 - 1. Proportion and design mixes to result in concrete slump at point of placement of not less than one inch and not more than four inches.
 - 2. When using high-range water reducers, slump prior to addition of admixture shall not exceed three inches. Slump after adding admixture shall not exceed eight inches at point of placement.

- D. Adjustment of Concrete Mixes:
 - 1. Concrete mix design adjustments may be requested by CONTRACTOR when warranted by characteristics of materials, Site conditions, weather, test results, or other, similar circumstances.
 - 2. Submit for ENGINEER's approval laboratory test data for adjusted concrete mix designs, including compressive strength test results.
 - 3. Implement adjusted mix designs only after ENGINEER's approval.
 - 4. Adjustments to concrete mix designs shall not result in additional costs to OWNER.

2.03 FORM MATERIALS

- A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection. CONTRACTOR shall be

responsible for designing the formwork system to resist all applied loads including pressures from fluid concrete and construction loads.

- B. Smooth Form Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces in accordance with ACI 301.
- C. Unexposed Concrete Surfaces: Material to suit project conditions.
- D. Provide 3/4-inch chamfer at all external corners. Chamfer is not required at re-entrant corners unless otherwise shown or indicated.
- E. Form Ties:
 - 1. Provide factory-fabricated, removable, or snap-off metal form ties, that prevent form deflection and prevent spalling of concrete surfaces upon removal. Materials used for tying forms are subject to approval of ENGINEER.
 - 2. Unless otherwise shown or indicated, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5 inches from outer surface of concrete. Unless otherwise shown or indicated, provide form ties that, upon removal, will leave a uniform, circular hole not larger than one-inch diameter in the concrete surface.
 - 3. Ties for exterior walls, below-grade walls, and walls subject to hydrostatic pressure shall be provided with waterstops.
 - 4. Wire ties are unacceptable.

2.04 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars.
- B. Welded Wire Fabric: ASTM A185/A185M.
- C. Steel Wire: ASTM A82/A82M.
- D. Provide supports for reinforcing including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing in place.
 - 1. Use wire bar-type supports complying with CRSI MSP1 recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.
 - 2. For slabs on grade, use precast concrete blocks, four inches square minimum with compressive strength equal to or greater than the surrounding concrete, or supports with sand plates or horizontal runners where base materials will not support chair legs.

3. For all concrete surfaces where legs of supports are in contact with forms, provide supports having either hot-dip galvanized, plastic-protected, or stainless steel legs in accordance with CRSI MSP1.
 4. Provide precast concrete supports over waterproof membranes.
- E. Adhesive Dowels:
1. Dowels:
 - a. Dowel reinforcing bars shall comply with ASTM A615, Grade 60.
 2. Adhesive:
 - a. For requirements for adhesive, refer to Section 05 05 33, Anchor Systems.

2.05 RELATED MATERIALS

- A. Waterstops:
1. PVC Waterstops:
 - a. Manufacturers: Provide products of one of the following:
 - 1) W.R. Meadows, Inc.
 - 2) Greenstreak Plastic Products Company.
 - 3) Or equal.
 - b. Waterstops shall comply with CRD-C 572. Do not use reclaimed or scrap material.
 - c. Minimum Thickness: 3/8-inch.
 - d. Provide waterstops with minimum of seven ribs equally spaced at each end on each side with the first rib located at the edge. Each rib shall be minimum 1/8-inch in height.
 - e. Construction Joints: Waterstops shall be six-inch wide flat-strip type.
 - f. Expansion Joints: Waterstops shall be nine-inch wide centerbulb type.
 2. Hydrophilic Waterstops:
 - a. Products and Manufacturers: Provide one of the following:
 - 1) Duroseal Gasket, by BBZ USA, Inc.
 - 2) Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
 - 3) Hydrotite, by Greenstreak Plastic Products Company.

- 4) Or equal.
 - b. Hydrophilic waterstop materials shall be bentonite-free and shall expand by minimum of 80 percent of dry volume in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.
 - c. Waterstop material shall be composed of resins and polymers that absorb water and cause a completely reversible and repeatable increase in volume.
 - d. Waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
 - e. Select material in accordance with manufacturer's recommendations for type of liquid to be contained.
 - f. Minimum cross-sectional dimensions: 3/16-inch by 3/4-inch.
 - g. Location of hydrophilic waterstops shall be as shown or indicated on the Drawings, or where approved by ENGINEER.
 - h. Hydrophilic Sealant: Shall adhere firmly to concrete, metal, and PVC in dry or damp condition and be indefinitely elastic when cured.
 - 1) Products and Manufacturers: Provide one of the following:
 - a) Duroseal Paste, by BBZ USA, Inc.
 - b) Adeka Ultraseal P-201, by Asahi Denka Kogyo K.K.
 - c) Hydrotite, by Greenstreak Plastic Products Company.
 - d) Or equal.
- B. Vapor Retarder:
- 1. Products and Manufacturers: Provide one of the following:
 - a. Stego Wrap Class A 10-mil Vapor Retarder, by Stego Industries LLC.
 - b. Griffolyn 10-mil, by Reef Industries.
 - c. Moistop Ultra 10, by Fortifiber Industries.
 - d. Or equal.
 - 2. Vapor retarder membrane shall comply with the following.
 - a. Water Vapor Transmission Rate, ASTM E96/E96M: 0.04 perms or lower.
 - b. Water Vapor Retarder, ASTM E1745: Meets or exceeds Class C.
 - c. Thickness of Retarder (plastic), ACI 302 1R: Not less than 10 mils.
 - d. Provide accessories by same manufacturer as vapor retarder.
- C. Membrane-Forming Curing Compound: ASTM C309, Type I.

- D. Epoxy Bonding Agent:
 - 1. Two-component epoxy resin bonding agent.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Sikadur 32, Hi-Mod LPL, by Sika Corporation.
 - b. Dural LPL MV, by the Euclid Chemical Company.
 - c. Or equal.

- E. Epoxy-Cement Bonding Agent:
 - 1. Three-component blended epoxy resin-cement bonding agent.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Sika Armatec 110 EpoCem, by Sika Corporation.
 - b. Duralprep A.C., by Euclid Chemical Company.
 - c. Or equal.

- F. Preformed Expansion Joint Filler:
 - 1. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).

- G. Joint Sealant and Accessories:
 - 1. For joint sealants and accessories used on isolation joints, control joints, and expansion joints, refer to Section 07900, Joint Sealants.

2.06 GROUT

- A. Non-shrink Grout:
 - 1. Pre-packaged, non-metallic, cementitious grout requiring only the addition of water at the Site.
 - 2. Minimum 28-day Compressive Strength: 7,000 psi.
 - 3. Products and Manufacturers: Provide one of the following:
 - a. NS Grout by Euclid Chemical Company.
 - b. MasterFlow 100 by Master Builders Solutions by BASF.

- c. Five Star Grout by Five Star Products, Inc.
 - d. Or equal.

- B. Epoxy Grout:
 - 1. Pre-packaged, non-shrink, non-metallic, 100 percent solids, solvent-free, moisture-insensitive, three-component epoxy grouting system.
 - 2. Minimum Seven-day Compressive Strength: 14,000 psi, when tested in accordance with ASTM C579.
 - 3. Products and Manufacturers: Provide one of the following:
 - a. Euco High Strength Grout, by Euclid Chemical Company.
 - b. Sikadur 42, Grout Pak, by Sika Corporation.
 - c. Five Star Epoxy Grout, by Five Star Products, Inc.
 - d. Or equal.

- C. Grout Fill:
 - 1. Grout mix shall consist of cement, fine and coarse aggregates, water, and admixtures complying with requirements specified in this Section for similar materials in concrete.
 - 2. Proportion and mix grout fill as follows:
 - a. Minimum Cement Content: 564 pounds per cubic yard.
 - b. Maximum Water-Cement Ratio: 0.45.
 - c. Maximum Coarse Aggregate size: 1/2-inch, unless otherwise indicated.
 - d. Minimum 28-day Compressive Strength: 4,000 psi.

PART 3 – EXECUTION

3.01 3.1 INSPECTION

- A. CONTRACTOR shall examine the substrate and the conditions under which the Work will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 FORMWORK

- A. Construct formwork in accordance with ACI 347 such that concrete members and structures are of correct size, shape, alignment, elevation, and position.
- B. Provide openings in formwork to accommodate the Work of other trades. Accurately place and securely support items required to be built into formwork.
- C. Clean and adjust forms prior to placing concrete. Apply form release agents or wet forms as required. Re-tighten forms during and after concrete placing, when required, to eliminate cement paste leaks.
- D. Removing Formwork:
 - 1. Comply with ACI 301 and ACI 347, except as otherwise indicated in the Contract Documents.
 - 2. Do not remove formwork and shoring until supported concrete members have acquired minimum of 90 percent of specified compressive strength. Results of suitable quality control tests of field-cured specimens may be submitted to ENGINEER for review as evidence that concrete has attained sufficient strength for removal of supporting formwork and shoring prior to removal times indicated in the Contract Documents.
 - 3. Removal time for formwork is subject to ENGINEER's acceptance.
 - 4. Repair form tie-holes following in accordance with ACI 301.

3.03 REINFORCING, JOINTS, AND EMBEDDED ITEMS

- A. Comply with the applicable recommendations of Laws and Regulations and standards referenced in this Section, including CRSI MSP1, for details and methods of placing and supporting reinforcing.
- B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials which act to reduce or destroy bond between reinforcing material and concrete.
- C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by means of metal chairs, runners, bolsters, spacers, and hangers, as required.
 - 1. Place reinforcing to obtain minimum concrete coverages as shown on the Drawings and as required in ACI 318. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcing accurately in position during concrete placing. Set with ties so that twisted ends are directed away from exposed concrete surfaces.

2. Do not secure reinforcing to formwork using wire, nails or other ferrous metal. Metal supports subject to corrosion shall not be in contact with formed or exposed concrete surfaces.
- D. Provide sufficient quantity of supports of strength required to carry reinforcing. Do not place reinforcing more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
 - E. Splices: Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown or indicated for minimum lap of spliced bars, [as shown on the Drawings.] [in accordance with the requirements of ACI 318/350.]
 - F. Install welded wire fabric in lengths as long as practical, lapping adjoining sections a minimum of one full mesh.
 - G. Do not place concrete until reinforcing is inspected and ENGINEER indicates that conditions are acceptable for placing concrete. Concrete placed in violation of this paragraph will be rejected. Notify ENGINEER in writing at least two working days prior to proposed concrete placement.
 - H. Joints:
 1. Provide construction, isolation, expansion, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs-on-grade to stabilize differential settlement and random cracking.
 2. In walls, locate joints at a maximum spacing of 40 feet and approximately 12 feet from corners.
 3. In foundation slabs and slabs-on-grade, locate joints at intervals of approximately 40 feet.
 4. In mats and structural slabs and beams, locate joints in compliance with ACI 224R.
 5. Locations of joints shall be in accordance with the Contract Documents and as approved by ENGINEER in the Shop Drawings.
 6. Where construction joints are indicated to be roughened, intentionally roughen surfaces of previously-placed concrete to amplitude of 1/4-inch.
 - I. Installation of Embedded Items: Set and build into the Work anchorage devices and embedded items required for other Work that is attached to, or supported by, cast-in-place concrete. Use setting diagrams, templates, and instructions provided under other Sections for locating and setting. Refer to Paragraph 1.1.B of this Section. Do not embed in concrete uncoated

aluminum items. Where aluminum items are in contact with concrete surfaces, coat aluminum to prevent direct contact with concrete.

J. Adhesive Dowels:

1. Adhesive dowels shall be reinforcing bar dowels set in an adhesive in hole drilled into hardened concrete. Comply with adhesive system manufacturer's installation instructions regarding hole diameter, drilling method, embedment depth required to fully develop required tensile strength, and hole cleaning and preparation instructions. Unless more-stringent standards are required by adhesive system manufacturer, comply with the following.
2. Drill holes to adhesive system manufacturer's recommended diameter and depth to develop required tensile strength. Holes shall not be more than 1/4-inch greater than nominal bar diameter, and hole depth shall not be less than twelve times nominal bar diameter. Hammer-drill holes. Cored holes are not allowed.
3. Embedment depths shall be based on concrete compressive strength of 2,000 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.
4. Determine location of existing reinforcing steel in vicinity of proposed holes prior to drilling. Adjust location of holes to be drilled to avoid drilling through or damaging existing reinforcing bars only when approved by ENGINEER.
5. Before setting adhesive dowel, hole shall be free of dust and debris using method recommended by adhesive system manufacturer. Hole shall be brushed, with manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
6. Inject adhesive into hole through injection system mixing nozzle and necessary extension tubes, placed to bottom of hole. Withdraw discharge end as adhesive is placed, but keep end of tube immersed to prevent forming air pockets. Fill hole to depth that ensures that excess material is expelled from hole during dowel placement.
7. Twist dowels during insertion into partially-filled hole to guarantee full wetting of bar surface with adhesive. Insert bar slowly to avoid developing air pockets.

3.04 CONCRETE PLACING

- A. Site Mixing: Use drum-type batch machine mixer, mixing not less than 1.5 minutes for one cubic yard or smaller capacity. Increase required mixing time by minimum of 15 seconds for each additional cubic yard or fraction thereof.
- B. Ready-Mixed Concrete: Comply with ASTM C94/C94M.
- C. Concrete Placing:

1. Place concrete in a continuous operation within planned joints or sections in accordance with ACI 304R.
 2. Do not begin placing concrete until work of other trades affecting concrete is completed.
 3. Wet concrete and subgrade surfaces to saturated surface dry condition immediately prior to placing concrete.
 4. Deposit concrete as near its final location as practical to avoid segregation due to re-handling or flowing.
 5. Avoid separation of the concrete mixture during transportation and placing. Concrete shall not free-fall for distance greater than four feet during placing.
 6. Complete concrete placing within 90 minutes of addition of water to the dry ingredients.
- D. Consolidate placed concrete in accordance with ACI 309R using mechanical vibrating equipment supplemented with hand rodding and tamping, such that concrete is worked around placing and other embedded items and into all parts of formwork. Insert and withdraw vibrators vertically at uniformly-spaced locations. Do not use vibrators to transport concrete within the formwork. Vibration of formwork or placing is not allowed.
- E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.
1. In hot weather comply with ACI 305R.
 2. In cold weather comply with ACI 306R.

3.05 QUALITY OF CONCRETE WORK

- A. Make concrete solid, compact, smooth, and free of laitance, cracks, and cold joints.
- B. Concrete for liquid-retaining structures and concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
- C. Cut out and properly replace to extent directed by ENGINEER, or repair to satisfaction of ENGINEER, surfaces that contain cracks or voids, are unduly rough, or are in defective in any way. Patches or plastering are unacceptable.
- D. Repair, removal and replacement of defective concrete directed by ENGINEER shall be at no additional cost to OWNER.

3.06 CURING

- A. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by using moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until formwork is removed. Provide protection, as required, to prevent damage to exposed concrete surfaces. Total curing period shall not be less than seven days. Curing methods and materials shall be compatible with scheduled finishes.

3.07 FINISHING

- A. Slab Finish:
 - 1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently. Use a wood float only. Check and level surface plane to a tolerance not exceeding 1/4-inch in ten feet when tested with a ten foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture. Slab surfaces shall receive a float finish. Provide additional trowel finishing as required in this Section.
 - 2. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over the surface.
 - 3. Consolidate concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in ten feet when tested with a ten-foot straightedge. Grind smooth surface defects that would telegraph through applied floor covering system.
 - 4. Use trowel finish for the following:
 - a. Interior exposed slabs, unless otherwise shown or indicated.
 - b. Apply non-slip broom finish, after troweling, to exterior concrete slab and elsewhere as shown.
- B. Apply chemical floor hardener to exposed interior concrete floor areas when cured and dry, in accordance with hardener manufacturer's instructions.
- C. Formed Finish:

1. Provide smooth form concrete finish at exposed surfaces. Use largest practical form panel sizes to minimize form joints. Exposed surfaces include interior water-contacting surfaces of tanks, whether or not directly visible. All surfaces shall be considered as exposed, unless buried or covered with permanent structural or architectural material. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/8-inch in height. Where surface will be coated or will receive further treatment, remove all fins flush with concrete surface.
2. Provide rough form finish at all unexposed surfaces. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/2-inch in height.

3.08 GROUT PLACING

- A. Place grout as shown and indicated, and in accordance with grout manufacturer's instructions and recommendations. If grout manufacturer's instructions conflict with the Contract Documents, notify ENGINEER and not proceed until obtaining ENGINEER's clarification.
- B. Dry-packing is not allowed, unless otherwise indicated.
- C. Manufacturers of proprietary grout materials shall make available upon 72 hours notice the services of qualified, full-time, factory-trained employee to aid in ensuring proper use of grout materials at the Site.
- D. Placing grout shall comply with temperature and weather limitations described in Article 3.4 of this Section.

3.09 FIELD QUALITY CONTROL

- A. Site Testing Services:
 1. OWNER will employ testing laboratory to perform field quality control testing for concrete. ENGINEER will direct the testing requirements.
 2. Testing laboratory will provide all labor, material, and equipment required for sampling and testing concrete, including: scale, glass tray, cones, rods, molds, air tester, thermometer, and other incidentals required.
- B. Quality Control Testing During Construction:
 1. Perform sampling and testing for field quality control during concrete placing, as follows:
 - a. Sampling Fresh Concrete: ASTM C172.

- b. Slump: ASTM C143/C143M; one test for each concrete load at point of discharge.
- c. Concrete Temperature: ASTM C1064/C1064M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed. Test each load when time from batching to placement exceeds 75 minutes.
- d. Air Content: ASTM C231; one for every two concrete load at point of discharge, and when a change in the concrete is observed.
- e. Unit Weight: ASTM C138/C138M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed.
- f. Compression Test Specimens:
 - 1) In accordance with ASTM C31/C31M, make one set of compression cylinders for each 50 cubic yards of concrete, or fraction thereof, of each mix design placed each day. Each set shall be four standard cylinders, unless otherwise directed by ENGINEER.
 - 2) Cast, store, and cure specimens in accordance with ASTM C31/C31M.
- g. Compressive Strength Tests:
 - 1) In accordance with ASTM C39/C39M; one specimen tested at seven days, and three specimens tested at 28 days.
 - 2) Concrete that does not comply with strength requirements will be considered as defective Work.
- h. Within 24 hours of completion of test, testing laboratory will transmit certified copy of test results to CONTRACTOR and ENGINEER.
- i. When there is evidence that strength of in-place concrete does not comply with the Contract Documents, CONTRACTOR shall employ the services of concrete testing laboratory to obtain cores from hardened concrete for compressive strength determination. Cores and tests shall comply with ASTM C42/C42M and the following:
 - 1) Testing of Adhesive Dowels: OWNER will employ testing agency to perform field quality control testing of drilled dowel installations. After adhesive system manufacturer's recommended curing period and prior to placing connecting reinforcing, proof-test for pullout ten percent of adhesive dowels installed. Adhesive dowels shall be tensioned to 60 percent of specified yield strength. Where dowels are located less than six bar diameters from edge of concrete, ENGINEER will determine tensile load required for test. If one or more dowels fail, retest all dowels installed for the Work. Dowels that fail shall be reinstalled and retested at CONTRACTOR's expense.

++ END OF SECTION ++

SECTION 03600

GROUTING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Section includes: Grout for column base plates, other structural supports, equipment bases, reinforcing bar dowels, surface repair, grout toppings, patching of fresh concrete, and uses other than masonry. Adhesive anchor bolt grouting is specified in Section 05050. Topping concrete over precast elements and clarifier topping concrete is specified in Section 03050.

1.02 RELATED SECTIONS

- A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
1. Section 03050 Concrete
 2. Section 05050 Anchor Bolts

1.03 REFERENCES:

- A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM C109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens)
ASTM C230	Flow Table for Use in Tests of Hydraulic Cement
ASTM C307	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
ASTM C939	Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
ASTM C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
ASTM C942	Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory

Reference	Title
ASTM C1107	Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
ASTM C1181	Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts
ASTM E329	Agencies Engaged in Construction Inspection, Testing, or Special Inspection
COE CRD-C611	Flow of Grout for Preplaced Aggregate Concrete
COE CRD-C621	Non-shrink Grout
IBC	International Building Code

1.04 SUBMITTALS

A. Action Submittals

1. Procedure: Section 01300:
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Complete product literature, including mixing, handling and placement instructions for the following: Cementitious non-shrink grout, epoxy grout, adhesive for reinforcing bar dowel grouting, concrete repair mortar, and prepackaged cement grout products to be used on the project.
5. Mix design for cement grout that is not prepackaged, including product data for aggregates and cement in accordance with Section 03050.
6. Current ICC Evaluation Service reports for adhesives used for reinforcing dowels.
7. Installer certification in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined reinforcing bar dowels grouted using adhesive.
8. Certified test results verifying the compressive strength, shrinkage and expansion requirements specified herein.

1.05 QUALITY ASSURANCE

A. Quality Control by Owner

1. The Owner will provide the services of a qualified Special Inspector in accordance with Section 01400.

2. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by a Special Inspector.
 - a. The Special Inspector shall furnish a report to the Engineer, Owner's Representative and Building Official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the approved Project Manual and the Manufacturer's Printed Installation Instructions (MPII).
- B. Quality Control by Contractor
 1. Provide the services of an independent testing laboratory which complies with the requirements of ASTM E329 if a product other than those listed below is proposed and test data is not available from the supplier to demonstrate equivalence to the specified grout. The testing laboratory shall sample and test the proposed grout materials. Costs of testing laboratory services shall be borne by the Contractor.
- C. Certifications
 1. Installer certification shall be in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined reinforcing bar dowels grouted using adhesive.
- D. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications.
 1. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.
 2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.
- E. Manufacturer Qualifications
 1. Manufacturer shall have a minimum of five years experience of producing products substantially similar to that required and shall be able to submit documentation of at least five satisfactory installations that have been in successful operation for at least five years each.
 2. When required, provide services of manufacturer's full-time employee, factory-trained in handling, use, and installing the products required, with at least five years of experience in field applications of the products required.

PART 2 PRODUCTS

2.01 CEMENTITIOUS NON-SHRINK GROUT

- A. The grout material shall be an approved ready to use mixture requiring only water for use at the job site. The 2-inch cubes shall have a minimum compressive strength of 3,000 psi at 7 days and 7,000 psi at 28 days.

- B. Cementitious non-shrink non-metallic aggregate grout shall be:
 - 1. BASF, Masterflow 928
 - 2. Euclid Chemical Company, Hi-Flow Grout
 - 3. Five Star Products, Inc., Five Star Grout
 - 4. Sika Corporation, SikaGrout 212
 - 5. Approved Equal
- C. Non-shrink grout shall conform to CRD-C 621 and ASTM C1107, Grade B or C when tested at a maximum fluid consistency of 30 seconds per ASTM C939 at temperature extremes of 45 degrees Fahrenheit and 90 degrees Fahrenheit and an extended working time of 15 minutes.
- D. Fluid grout shall pass through the flow cone, with continuous flow, one hour after mixing.

2.02 EPOXY GROUT FOR EQUIPMENT MOUNTING:

- A. Epoxy grout shall be a pourable, non-shrink, 100-percent solids system.
- B. Epoxy grout for equipment mounting shall be a non-cementitious, resin based, multi-component formulation. Epoxy grout shall be flowable, with shrinkage minimized to achieve minimum 98% effective bearing area. Epoxy grout shall be:
 - 1. BASF, Masterflow 648
 - 2. Euclid Chemical Company, E3-G
 - 3. Sika Corporation, Sikadur 42
 - 4. Approved Equal.
- C. The following properties shall be attained with the minimum quantity of aggregate allowed by epoxy grout manufacturer.
 - 1. Length change after hardening shall be less than 0.0006-inch per inch and coefficient of thermal expansion shall be less than 0.00003-inch per inch per degree F when tested in accordance with ASTM C531.
 - 2. Compressive creep at one year shall be less than 0.001-inch per inch when tested under a 400-psi constant load at 140 degrees F in accordance with ASTM C1181.
 - 3. Minimum seven-day compressive strength shall be 14,000 psi when tested in accordance with ASTM C579
 - 4. Grout shall be capable of maintaining at least a flowable consistency for minimum of 30 minutes at 70 degrees F.
 - 5. Shear bond strength to portland cement concrete shall be greater than shear strength of concrete when tested in accordance with ASTM C882/C882M.

2.03 ADHESIVE FOR GROUTING REINFORCING BAR DOWELS

- A. Adhesive for setting dowels in concrete shall be an injectable two-component epoxy adhesive. Adhesive shall be approved for the intended use per the product ICC Report. Adhesive shall be:
 - 1. Hilti, HIT-RE 500v3
 - 2. Simpson Strong Tie, SET XP

3. Approved Equal (equivalent product must have ICC approval for use in cracked concrete in areas with high seismic risk).
- B. Adhesive for setting dowels in concrete masonry shall be an injectable two-component epoxy adhesive. Adhesive shall be approved for the intended use per the product ICC Report or IAPMO Report. Adhesive shall be:
1. Hilti, HIT-HY 70
 2. Simpson Strong Tie, SET XP
 3. Approved Equal

2.04 CONCRETE REPAIR MORTAR

- A. Horizontal Applications: Repair mortars shall be:
1. BASF, MasterEmaco S 466CI
 2. Sika Corporation, SikaTop 111 Plus
 3. Approved Equal
- B. Vertical and Overhead Applications: Repair mortars shall be:
1. BASF, MasterEmaco 1500HCR Vertical Overhead
 2. Sika Corporation, SikaTop 123 Plus
 3. Approved Equal

2.05 CEMENT GROUT

- A. Cement grout shall be comprised of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed in accordance with this Section.
1. Minimum Compressive Strength: 4,500 psi at 28 days.
 2. Maximum Water Cement Ratio: 0.42 by weight.
 3. Coarse Aggregate: ASTM C33/C33M, No. 8 size.
 4. Fine Aggregate: ASTM C33/C33M, approximately 60 percent by weight of total aggregate.
 5. Air Content: Five percent (plus or minus one percent).
 6. Minimum Cement Content: 564 pounds per cubic yard.
 7. Slump for grout fill shall be adjusted to match placing and finishing conditions, and shall not exceed four inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine and accept existing conditions before beginning work.

3.02 CEMENTITIOUS NONSHRINK GROUT

- A. Non-shrink, cementitious, nonmetallic aggregate grout shall be used for column base plates, structural bearing plates, and all locations where the general term “non-shrink grout” is indicated on the Drawings. Use of this grout to support the bearing surfaces of machinery or as detailed on the Drawings for specific locations or pieces of equipment. If

guidance is not provided in locations noted above, use of non-shrink grout for equipment mounting shall be limited to equipment less than 25 horsepower or 750 pounds. Grout shall be placed and cured in accordance with the manufacturer's instructions.

- B. Non-shrink cementitious grout shall not be used as a surface patch or topping. Non-shrink cementitious grout must be used in confined applications only.

3.03 EPOXY GROUT FOR EQUIPMENT MOUNTING

- A. Prepare concrete surfaces of equipment pads as indicated in details on the Drawings and as required by the epoxy grout manufacturer. Epoxy grout for equipment mounting shall be placed and cured in conformance with manufacturer's recommendations.

3.04 ADHESIVE FOR GROUTING REINFORCING BAR DOWELS

- A. Follow manufacturer's instructions.

3.05 CONCRETE REPAIR MORTAR

- A. Concrete repair materials and procedures shall be submitted for review to the Owner's Representative and shall be accepted prior to commencement of the repair work.
- B. Follow all manufacturer's instructions, including those for minimum and maximum application thickness, surface preparation and curing. Add aggregate as required per manufacturer's recommendations. Any deviations from the manufacturer's instructions shall be submitted for review to the Owner's Representative and shall be accepted prior to commencement of the work.

3.06 CEMENT GROUT

- A. Cement grout shall be used for grout toppings less than four inches thick and for patching of fresh concrete.
- B. Grouting shall comply with temperature and weather limitations in Section 03050, Concrete.
- C. Cure grout in accordance with grout manufacturer's instructions for prepackaged grout and Section 03050, Concrete, for non-prepackaged cement grout.

END OF SECTION

SECTION 05050
ANCHOR BOLTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Bolts and all-thread rods used to attach structural elements and equipment to concrete. Included are cast-in-place and post-installed anchors (adhesive systems and wedge type expansion anchors), nuts and washers.
- B. Cast-in-place and post-installed anchors shall be Type 316 stainless steel unless noted otherwise.

1.01 RELATED SECTIONS

- A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
 - 1. Section 01900 Design Requirements for Nonstructural Components and Nonbuilding Structures
 - 2. Section 03050 Concrete

1.02 REFERENCES

- A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 318	Building Code Requirements for Structural Concrete
ASTM A193	Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A320	Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A563	Carbon and Alloy Steel Nuts
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
ASTM F844	Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1554	Anchor Bolts, Steel, 36, 55, 105-ksi Yield Strength
IBC	International Building Code with local amendments
MA SBC	Massachusetts State Building Code with local amendments

1.03 SUBMITTALS

A. Action Submittals

1. Procedures: Section 01300.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Anchor bolt placement plans.
5. Anchor bolt, nut, and washer material information, including material certifications.
6. Record copy of design calculations and details showing the required diameter, length, embedment, edge distance, confinement, anchor reinforcement, anchor bolt sleeves, connection redesign, and other conditions, stamped and signed by a Professional Engineer currently registered in the state of Massachusetts. Calculations shall comply with the provisions of ACI 318-14, Chapter 17 . Base anchor capacity determination on cracked concrete condition and compressive strength of new concrete per Section 03050. Assume compressive strength of existing concrete is 3,000 psi unless otherwise noted.
7. Product Data:
 - a. ICC Evaluation Service Reports for post-installed adhesive type anchors and expansion (wedge type) anchors when allowed. Products shall be ICC approved for use in cracked concrete in high seismic areas (Seismic Design Category D, E and F).
 - b. Product data indicating load capacity charts/calculations.
 - c. Chemical resistance.
 - d. Temperature limitations.
 - e. Manufacturers written installation instructions.
8. Installer certification for horizontal or upwardly inclined adhesive anchors in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program.

1.04 QUALITY ASSURANCE

A. Quality Assurance By Owner

1. Special inspection of anchor bolts shall be performed by the Special Inspector under contract with the Owner and in accordance with IBC Chapter 17.
2. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by a Special Inspector.
3. The Special Inspector shall furnish a report to the Engineer, Owner's Representative, and Building Official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the

approved Project Manual and the Manufacturer’s Printed Installation Instructions (MPII).

B. Certifications

1. Installer certification shall be in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined adhesive anchors.

PART 2 PRODUCTS

2.01 GENERAL

- A. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 1/4 inch. Minimum anchor bolt diameter shall be 1/2 inch.
- B. Tapered washers shall be provided where mating surface is not square with the nut.
- C. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings. Substitution of post-installed anchors will not be permitted unless specifically requested by the Contractor and approved by the Engineer.

2.02 PERFORMANCE/DESIGN CRITERIA

- A. Anchor bolts for equipment shall be designed by the equipment manufacturer to include equipment operational loads combined with seismic and wind forces when applicable. Design criteria provided in Section 01900.
- B. Design anchor bolts for support and bracing of non-structural components and non-building structures for loading specified in Section 01900.

2.03 MATERIALS

- A. Anchor bolt materials shall be as specified in the following table:

Material	Specification
Stainless Steel Anchor Bolts	ASTM A193 or A320, Type 316
Stainless Steel Threaded Rods	ASTM F593, Type 316
Stainless Steel Nuts	ASTM A194 Heavy Hex Nuts, Type 316 ASTM F594 Heavy Hex Nuts at Adhesive Anchors, Type 316 ASTM A194 Heavy Hex Nuts Grade 8S (Nitronic 60)
Stainless Steel Washers	Type 316 to match bolt material
Carbon Steel Anchor Bolts	ASTM F1554, Grade 36, Hot Dip Galvanized
High-Strength Carbon Steel Anchor Bolts	ASTM F1554, Grade 55, Weldable per Supplementary Requirement S1, Hot Dip Galvanized
Carbon Steel Nuts and Washers	ASTM A563 and F844, Heavy Hex, Hot-Dip Galvanized
Concrete Adhesive Anchors	Hilti "HIT-RE 500v3", Simpson Strong-Tie "SET-XP", or approved equal, with Type 316 Stainless Steel threaded rods
Concrete Masonry Adhesive Anchors	Hilti "HIT-HY 70", Simpson Strong-Tie "SET-XP", or approved equal, with Type 316 Stainless Steel threaded rods

Material	Specification
Concrete Masonry Expansion (wedge) Anchors*	Hilti "KWIK BOLT 3", or approved equal, Type 316 Stainless Steel
Concrete Expansion (wedge) Anchors *	Hilti "KWIK BOLT TZ", or approved equal, Type 316 Stainless Steel

**Post installed anchors shall always be an adhesive type anchor system except where noted otherwise or when Contractor makes a request for a specific application and Engineer approves.*

2.04 STAINLESS STEEL FASTENER LUBRICANT (ANTI-SEIZING)

- A. Anti-seizing Lubricant for Stainless Steel Threaded Connections:
 1. Formulated to resist washout.
 2. Acceptable manufacturers are Bostik, Saf-T-Eze, or equal.

2.05 ANCHOR BOLT SLEEVES

- A. Provide anchor bolt sleeves as shown on design drawings and as required by equipment manufacturer's design.
 1. Provide high density polyethylene plastic sleeves of single unit construction with deformed sidewalls such that the concrete and grout lock in place.
 2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
 3. Acceptable manufacturers are Contec, Wilson, or equal.

PART 3 EXECUTION

3.01 GENERAL

- A. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings.
- B. Grouting of anchor bolts using plastic sleeves with non-shrink or epoxy grout, where specified, shall be in accordance with Section 03600.
- C. The threaded end of anchor bolts and all-thread rods shall be long enough to project through the entire depth of the nut and if too long, shall be cut off at ½-inch beyond top of nut and ground smooth.

3.02 CAST-IN-PLACE ANCHOR BOLTS

- A. Anchor bolts to be embedded in concrete shall be placed accurately and held in correct position using templates while the concrete is placed.
- B. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.

3.03 ADHESIVE ANCHOR BOLTS

- A. Note that adhesive anchors shall not be substituted for cast-in-place anchor bolts unless the adhesive anchors have been specified or shown on the Drawings, or approval has

been obtained from the Engineer that substitution of adhesive anchors is acceptable for the specific use and location. Use of adhesive anchors shall be subject to the following conditions:

1. Limit to locations where intermittent or continuous exposure to the following is extremely unlikely:
 - a. Acid concentrations higher than 10 percent
 - b. Chlorine gas
 - c. Machine or diesel oils
2. Limit to applications where exposure to the following is extremely unlikely:
 - a. Fire
 - b. Concrete or rod temperature above 120 degrees F
3. Overhead applications (such as pipe supports) shall not be allowed unless approved by the Engineer and installation is by an Installer specially certified for overhead applications.
4. Approval from Engineer for specific application and from supplier of equipment to be anchored, if applicable.
5. Anchor diameter and material shall be per Contract Documents or equipment manufacturer's specifications. Anchor shall be threaded or deformed the full length of embedment and shall be free of rust, scale, grease, and oils.
6. Embedment depth shall be as specified or as required by the equipment manufacturer.
7. Follow the anchor system manufacturer's installation instructions.
8. Holes shall have rough surfaces created by using a hammer drill with carbide bit. Core drilled holes are not allowed.
9. Holes shall be blown clean with oil-free compressed air and be free of dust or standing water prior to installation. Follow additional requirements of the adhesive manufacturer.
10. Concrete and air temperature shall be compatible with curing requirements of adhesives per adhesive manufacturer's instructions. Anchors shall not be placed in concrete when the temperature is below 25 degrees F.
11. Anchors shall be left undisturbed and unloaded for full adhesive curing period, which is based on temperature of the concrete.

3.04 EXPANSION ANCHORS

- A. Expansion (wedge type) anchors shall not be substituted for cast-in-place anchor bolts or adhesive anchors unless approved by the Engineer for a specific application. Use of expansion anchors shall be subject to conditions 4 through 9 as specified above for adhesive anchors. Expansion anchors shall not be used in a submerged condition or in mounting of equipment subject to vibration or cyclic motion.

3.05 REINFORCING STEEL CONFLICTS WITH POST-INSTALLED ANCHOR INSTALLATION

- A. When reinforcing steel is encountered in the drill path, slant drill to clear obstruction and provide beveled washer to match angle of anchor. Drill shall not be slanted more than 10 degrees.

- B. Where slanting the drill does not resolve the conflict, notify the Owner's Representative and resolve the conflict to the satisfaction of the Owner's Representative in consultation with the Engineer.
- C. Abandoned post-installed anchor holes shall be cleaned and filled with non-shrink grout and struck off flush with adjacent surface.
- D. The costs of determining and executing the resolution shall be borne by the Contractor. The determination and execution of the resolution shall not result in additional cost to the Owner.
- E. Reinforcing steel in masonry shall not be damaged.
- F. In order to avoid or resolve a conflict, locate embedded reinforcing steel using non-destructive methods and/or redesign the attachment.
 - 1. Redesign shall be done by the Contractor's Professional Engineer currently registered in the state of Massachusetts.
 - 2. Calculations and details for redesign shall be submitted.

END OF SECTION

SECTION 07900
JOINT SEALANTS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies sealants for outlet weir structure.

1.02 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
FEDSPEC TT-S-00230C	Sealing Compound: Elastomeric Type, Single Component
FEDSPEC TT-S-00227E	Sealing Compound: Elastomeric Type, Multi-Component

PART 2 PRODUCTS

2.01 POLYURETHANE SEALANT

A. Acceptable Products:

1. Acceptable products shall be Sikaflex by Sika Chemical Corporation, Vulkem by Mameco International, U-Seal Joint Sealant by Burke Company, or Rubber Calk by Products Research and Chemical Corporation.

B. General:

1. Polyurethane sealants shall conform to FEDSPEC TT-S-0230C for one-component systems and FEDSPEC TT-S-00227E for two-component systems. Polyurethane sealant shall be one of the following two types.
 - a. Self-Leveling:
 - 1) Self-leveling polyurethane sealant shall be Type I, Class A as specified by the FEDSPECs referenced above.
 - b. Nonsag:

- 1) Nonsag polyurethane sealant shall be Type II, Class A as specified by the FEDSPECS referenced above.

C. Primer:

1. Primer shall be as recommended by the sealant manufacturer.

D. Backer Rod or Backer Tape:

1. Backer rod shall be open cell polyethylene or polyurethane foam. Rod shall be cylindrical unless otherwise specified. Backer tape shall be polyethylene or polyurethane with adhesive on one side.

2.02 MASTIC SEALANT

A. General:

1. Mastic joint sealant shall consist of a blend of refined asphalts, resins and plasticizing compounds, reinforced with fiber. Sealant shall be compatible with joint fillers and shall be pressure grade.

B. Primer:

1. Primer shall be as recommended by the mastic sealant manufacturer.

2.03 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01300:

1. Manufacturer's product data showing conformance to the specified products.
2. Manufacturer's recommendations for storage, handling and application of sealants and primers.

PART 3 EXECUTION

3.01 GENERAL

- A. Sealants and primers shall be applied according to the sealant manufacturer's recommendations. Polyurethane sealants shall be used on all expansion joints and specified construction joints.
- B. Joints and spaces to be sealed shall be clean, dry and free of dust, loose mortar, concrete and plaster. Additional preparation of joints and spaces shall be provided in accordance with manufacturer's recommendations. Primer shall be applied only to the surfaces that will be covered by the sealant.

3.02 POLYURETHANE SEALANTS

A. General:

1. Nonsag polyurethane sealants shall be used on vertical joints. Self-leveling polyurethane sealants shall be used on horizontal joints.

B. Joint Dimensions:

1. Unless otherwise specified, joints and spaces to be filled shall be constructed to the following criteria. Joints and spaces shall have a minimum width of 1/4 inch and a

maximum width of 1 inch. The depth of the sealant shall be one-half the width of the joint, but in no case less than 1/4 inch deep. Sealant depth shall be measured at the point of smallest cross section. When joints exceed the depth requirements, backing rod shall be inserted to provide the joint depth specified. If the joint sealant depth is within the specified tolerances, backer tape shall be placed in the bottom of the joint.

3.03 MASTIC SEALANT

A. Joint Dimensions:

1. Joints to be sealed shall be 2 inches deep, 1 inch wide at the top, and 3/4 inch wide at the base.

END OF SECTION

SECTION 07905

JOINT FILLERS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies preformed joint fillers.

1.02 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM D994	Preformed Expansion Joint Filler for Concrete (Bituminous Type)
ASTM D1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

PART 2 PRODUCTS

2.01 PREFORMED ASPHALT FIBERBOARD

A. Preformed asphalt fiberboard joint filler shall be in accordance with ASTM D994 and shall be 1/2 inch thick unless otherwise specified.

2.02 PREFORMED RESIN-BONDED CORK

A. Preformed resin-bonded cork joint filler shall be in accordance with ASTM D1752, Type II. Cork joint filler thickness shall match the specified joint width.

2.03 PRODUCT DATA

- A. The following information shall be provided in accordance with Section 01300:
1. Manufacturer's recommendations for handling and installation of the material.

PART 3 EXECUTION

3.01 GENERAL

- A. Preformed joint fillers shall be placed into position before the concrete is poured. Where it is necessary for the filler to be fixed to existing concrete or other building materials, a suitable adhesive recommended by the filler manufacturer shall be used. Filler surfaces shall be clean and dry prior to the placement of the concrete.

3.02 PREFORMED ASPHALT FIBERBOARD

- A. Preformed asphalt fiberboard joint fillers shall be used for expansion joints in concrete sidewalks, curbs, and roadways.

3.03 PREFORMED RESIN-BONDED CORK

- A. Preformed resin-bonded cork joint filler shall be used for expansion joints in concrete structures. The expansion joint shall be sealed with backer rod and sealant as specified in Section 07900.

END OF SECTION

SECTION 11200
STAINLESS STEEL SLIDE GATE

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The CONTRACTOR shall furnish all labor, materials, 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 be supplied in accordance with the latest edition of AWWA C561 Standard for Fabricated Stainless Steel Slide Gates except where the detailed specifications within this section provide for additional requirements. Although a manufacturer may be named as an acceptable manufacturer, submitting a "standard" gate that does not meet AWWA C561 and the detail requirements listed within this section will result in rejection.
- C. The allowable leakage rate for the stainless steel gates in this specification shall be 0.05 gpm/ft of seal perimeter which is 1/2 the allowable leakage listed in the latest revision of AWWA C561.

1.02 QUALITY ASSURANCE

- A. All equipment shall conform to the following criteria:
 - 1. Equipment shall be manufacturer's standard products presently in commercial production.
 - 2. All the equipment specified under this Section shall be furnished by a single supplier and shall be products of manufacturers regularly engaged in the production of said equipment. The supplier shall have the sole responsibility for proper functioning of the slide gates.
 - 3. Any reference to a specific manufacturer or model number is for the purpose of establishing a quality or parameter for specification writing and is not to be considered proprietary. In all cases any source or device that has the quality and operating capabilities specified may be acceptable.
 - 4. Conform to requirements for material, installation and equipment approvals of state, local, Underwriter's Laboratories, Inc., or other applicable codes, whether or not called for on the drawings or in the specifications.
 - 5. Base the use of unspecified materials on their continuous and successful employment under similar conditions, as called for in this Section.
- B. Qualifications
 - 1. All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 10 years experience designing and manufacturing water control slide gates. The manufacturer shall have manufactured water control slide gates for a minimum of 100 projects located in the United States. The manufacturer shall provide an installation list, certified by an official of the company that the installation list is authentic, that the company has been manufacturing gates for a minimum of 10 years, and that the manufacturer supplied the gates for the

- projects. Please note that an installation list acquired during a purchase of a company is not acceptable.
2. If the gate(s) is imported, the gate manufacturer must perform a shop test in a facility located within the United States prior to shipping the gate(s) to the job site.
 3. The specification is based on the 900 Series Stainless Steel Gate as manufactured by Whipps, Inc. of Athol, Massachusetts.

1.03 SUBMITTALS

- A. Show principal dimensions and general construction of, and materials used in, all parts of the slide gate and lift mechanism.
- B. Provide the following information to confirm compliance with the specification.
 1. Certification letter, by an official of the company, that confirms that the company that the company has been manufacturing gates for a minimum of 10 years and that the manufacturer supplied the gates for the projects on the installation list.
 2. Installation List of a minimum of 100 projects with the United States where similar gates (material and size) were used. Please note that an installation list with different gate material or a list of installations acquired during a purchase of a company will not be considered.
 3. Complete description of all materials including the material thickness of all structural components of the frame and slide. Any submittal that does not indicate all material thickness will not be reviewed or approved.
 4. Installation drawings showing all details of construction, details required for installation, dimensions and anchor bolt locations.
 5. General Arrangement Drawings shall show dimensions of the gate in both the fully CLOSED and fully OPEN positions.
 6. Maximum bending stress and deflection of the slide under the maximum design head.
 7. 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.
 8. Location of the shop test shall be indicated in the submittal for any imported gates.
- C. Since every aspect of the AWWA C561 Standard for Fabricated Stainless Steel Slide Gates may not be able to be indicated in a submittal, the Engineer's Approval of the submitted design does not waive any requirement that is stipulated within the AWWA C561 standard.
- D. Illustrated catalog data and parts schedule
 1. Give sufficient detail to serve as a guide in assembly and disassembly of the gate and in ordering repair parts.
 2. Provide a recommended spare parts list.
- E. Affidavit of compliance
 1. The manufacturer shall provide an affidavit of compliance with all applicable provisions of this specification.
- F. Operation and maintenance manual

1. Furnish digital PDF and two (2) paper copies of the operation and maintenance manuals for each component specified.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Slide gates shall be complete when shipped and the manufacturer shall use all due and customary care in preparing them for shipment to avoid damage in handling or transit.
- B. Particular care shall be taken to see that the parts are completely closed and locked in position before shipment.
- C. Parts that are to be embedded in concrete may be shipped separately if requested by the Contractor.
- D. Slide gates shall be securely bolted or otherwise fastened to skids in such a manner that they may be safely handled.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General requirements
 1. All materials shall conform to the requirements designated below. Gates shall be as specified herein and have the characteristics and dimensions shown on the Contract Drawings. All hardware shall be galvanized steel.
 2. When reference is made to American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), Copper Development Association Alloy (CDA), or other standards as stipulated, the latest revision thereof shall apply.
 3. Test requirements or testing procedures, as specified by ANSI, ASTM, or other standard, shall be met by the manufacturer. If required, test records shall be made available to the Owner.
 4. Leakage shall not exceed 0.05 gpm/ft of wetted seal perimeter in seating head and unseating head conditions. Shop Leakage (required for imported gates) shall not exceed 0.025 gpm/ft of wetted seal perimeter in unseating head conditions.
 5. 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.
 6. All structural components of the frame and slide shall be fabricated of stainless steel having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
 7. All welds shall be performed by welders with AWS D1.6 certification.
 8. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale. All cast iron and steel components shall be properly prepared and shop coated with a primer. All castings shall be clean and sound, without defects which could impair their function.
- B. Components
 1. Frame Assembly and Retainers: Stainless Steel, Type 304L, ASTM A-240
 2. Slide and Stiffeners: Stainless Steel, Type 304L, ASTM A-240

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|---------------------------------|---|
| 3. Stem: | Stainless Steel, Type 304, ASTM A-276 |
| 4. Anchors Studs, Fasteners, | Stainless Steel, Type 316, ASTM A-276, F-593 & 594 |
| 5. Invert Seal: | Neoprene ASTM D-2000 or EPDM |
| 6. Seat/Seals and Facing: | Ultra-High Molecular Weight Polyethylene ASTM D4020 |
| 7. Lift Nuts: | Bronze ASTM B584 |
| 8. Pedestals and Wall Brackets: | Stainless Steel, Type 304L, ASTM A-276 |
| 9. Operator Housing: | Cast aluminum or ductile iron |

1.05 FABRICATION

A. Frames

1. 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 1/4-inch.
2. Frame design shall allow for embedded mounting or mounting directly to a wall with stainless steel anchor bolts and grout. Mounting style shall be as shown on the Drawings.
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. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully closed or fully opened position.
5. All the gates are to be self-contained gates with a yoke 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 rigid assembly. The yoke shall be designed to allow removal of the slide and sized to withstand normal operating loads as well as the maximum hoist output. The Yoke deflection shall not exceed 1/360 of the gate width or a maximum of 1/4" whichever is less at maximum operating load. The entire gate shall be shipped to the job site complete.
6. 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.
7. A rigid stainless steel top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.
8. All gates smaller than 96" x 96" shall be delivered to the job site fully assembled. Gates that require field assembly shall not be installed and shall be returned to the manufacturer for completion of assembly.
9. The gate shall be mounted to the face of the wall as shown on the contract drawings.

B. Slides

1. The slide and reinforcing stiffeners shall be constructed of stainless steel plate. All structural components shall have a minimum thickness of 1/4-inch.
2. The slide shall not deflect more than 1/720 of the span or 1/16 inch, whichever is smaller, under the maximum design head of 15 ft.
3. When the width of the gate opening multiplied by the maximum design head is 120 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 2.5 inches.

4. 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.
5. 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.

C. Seals

1. All gates shall be provided with a self-adjusting seal system to restrict leakage in accordance with the requirements listed in this specification.
2. 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.
3. The seat/seals shall extend to accommodate the 1-½ times the height of the slide when the slide is in the fully closed or fully opened position.
4. 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.
5. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
6. 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.
7. The seals shall be mounted so as not to obstruct the water way opening.
8. The seal system shall have been factory tested on a stainless steel gate 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.

D. Stems

1. 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. On non-rising stem gates, the threaded portion shall engage the nut on the slide.
2. The stem shall have a minimum diameter of 1-1/2 inches.
3. 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.
4. Stem extension pipes or extension tubes are not acceptable.
5. The stem shall be threaded to allow full travel of the slide – 3 ft.
6. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
7. 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.
8. 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.

9. The threaded portion of the stem shall have machine cut or rolled threads of the full Acme type with a 16 microinch finish or better.
 10. If the stem is over 120" long, it may be supplied as more than one section, joined by stainless steel or bronze couplings. The coupling shall be threaded and keyed or threaded and bolted to the stems.
 11. Stems, on manually operated gates, shall be provided with adjustable stop collars to prevent over closing of the slide.
- E. Stem guides (where applicable)
1. 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.
 2. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.
 3. Adjustable in two directions.
- F. Manual operators
1. Gates shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on the pedestal.
 2. 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.
 3. 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.
 4. 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, without tools using a locking pin, and shall have a minimum diameter of 15 inches.
 - e. The nut that engages with the handwheel shall be lockable with a padlock, to block unauthorized operation of the when the handwheel is removed.
 5. Crank- operated gearboxes shall be fully enclosed and shall have a cast aluminum or cast 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 with a minimum diameter of 1-inch 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.
 - i. The nut that engages with the crank shall be lockable with a padlock, to block unauthorized operation of the when the crank is removed.
6. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
- a. The pedestal height shall be as shown on the Drawings.
 - 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 ENGINEER. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.
7. 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 gate position.
- G. Assembly, studs, nuts, and anchor bolts
- 1. All assembly bolts, studs, nuts and anchor bolts shall be of such size and spacing as required to provide the design forces with a safety factor of five. Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances.
 - 2. Quantity and location shall be determined by the gate manufacturer.
 - 3. For epoxy/adhesive type anchor bolts, the slide gate manufacturer shall provide the studs, washers and nuts. The Contractor shall provide high strength epoxy/adhesive for anchor bolts.
 - 4. Anchor bolts shall have a minimum diameter of 1/2-inch.

PART 3 EXECUTION

3.01 INSPECTION

- A. The Engineer shall have access to all places of manufacture or where tests are being conducted, and shall be provided any facilities required for inspection and observation.
- B. Any slide gate or part which does not conform to the requirements of this standard shall be made to conform or shall be rejected and replaced.

3.02 SHOP TESTING

- A. If the gate is imported from outside the United States, after fabrication and prior to shipment to the job site, the gate(s) shall be water shop tested in a test facility located within the United States to ensure that the leakage does not exceed the specified allowable leakage of 0.025 gpm/ft of wetted seal perimeter. The ENGINEER may witness the shop test. If the ENGINEER does not witness the shop test, then the manufacturer must provide written certification and video taping of the testing signed by the shop foreman or supervisor.
- B. If the gate does not pass the shop leakage test, the gate manufacturer shall make any necessary changes and retest the gate.
- C. Only after the gate(s) pass the shop leakage rate shall the gate be allowed to be shipped.

3.03 INSTALLATION

- A. 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 drawings and recommendations.
- B. The CONTRACTOR shall review the installation drawings and installation instruction prior to installing the gates.
- C. During construction, the surfaces of the gate shall be covered or otherwise protected from concrete spillage, paint, oil and debris.
- D. Any damage that occurs to the gate in storage or handling shall be corrected prior to installation of the gate or operation and testing of the gate.
- E. The gate assemblies shall be installed in a true vertical plane, square and plumb. Operator shall be plumbed, shimmed and accurately aligned, and care shall be taken to avoid warping the gates and stems.
- F. 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.

3.04 FIELD QUALITY CONTROL

- A. The CONTRACTOR shall notify the gate manufacturer of the scheduled field testing in the sufficient time to enable him to have a representative present at the test.
- B. After installation, all gates shall be field tested in the presence of the ENGINEER 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.
- C. After all adjustments have been made and the mechanisms properly lubricated, each slide gate shall be operated through five complete cycles as a final check on proper operation before starting the leakage test.

- D. Each gate shall be water tested by the CONTRACTOR, at the discretion of the ENGINEER and OWNER, to confirm that leakage through the gate does not exceed the specified allowable leakage of 0.05 gpm/ft of wetted seal perimeter.

3.05 MANUFACTURER’S REPRESENTATIVE

- A. The gate manufacturer shall supply the services of a factory-employed field technician for a total of two (2) trips and two (2) 8-hour onsite days of field supervision to verify the installation and be present during the field leakage tests.
- B. The field technician shall examine completed slide gate installations and shall certify in writing that they have been properly installed.
- C. The field technician shall instruct the operating personnel on the operation and maintenance of the slide gates. The Owner reserves the right to videotape the instruction of the operating personnel.

GATE SCHEDULE

Gate Location	Gate Opening Width (in)	Gate Opening Height (in)	Gate Frame Height (in)	Design Head (ft)	Operating Head (ft)	Mounting Type	Actuator Type
YMCA wetland outlet	36	36	114	15 Unseating	15	Wall, Face	Manual, locking with handwheel removed

END OF SECTION