

SECTION 01630

PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Product options available to Contractor
- B. Procedures for securing acceptance of proposed Substitutions for a product which is specified in Contract Documents by reference to one or more of the following:
 - 1. Name of manufacturer
 - 2. Name of supplier
 - 3. Trade name
 - 4. Catalog model number

1.2 RELATED SECTIONS

- A. Section 01340—Shop Drawings, Product Data, and Samples

1.3 GENERAL REQUIREMENTS

- A. The Contract is based on standards of quality established in Contract Documents:
 - 1. In agreeing to terms and conditions of Contract, Contractor has accepted a responsibility to verify that specified products will be available and to place orders for all required materials in such a timely manner as is needed to meet construction schedule
 - 2. Neither Owner nor Engineer has agreed to substitution of materials or products called for in Contract Documents, except as they may specifically be stated otherwise in writing

1.4 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only—Any Product meeting those standards or description:
 - 1. Products specified by reference to standard specifications such as ASTM and similar standards
 - 2. Products specified by manufacturer's name and catalog model number
- B. Products Specified by Naming One or More Manufacturers—Products of manufacturers named and meeting specifications, no options or substitutions allowed:
 - 1. Where materials and/or products are specified by naming one single manufacturer and/or model number, without stating that Substitutions will be considered, only the material and/or products named are approved for incorporation into the Work

- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions—Submit a request for substitution for any manufacturer not named in accordance with this section:
 - 1. Where materials and/or products are specified by name and/or model number, followed by words “Or accepted substitution”:
 - a. The material and/or product specified by name establishes required standard of quality
 - b. Materials and/or product proposed by Contractor to be used in lieu of materials and/or products so specified by name shall in all ways equal or exceed the qualities of named materials and/or products
 - c. Proposed substitutions shall be presented at the pre-construction meeting
- D. Where phrase “or accepted substitution” occurs in contract documents, do not assume that materials, equipment or products will be accepted as substitution unless item has been specifically so reviewed for this Work by Engineer

1.5 SUBSTITUTIONS

- A. Engineer will consider requests for Substitutions only within 30 days after date of Owner-Contractor Agreement
- B. Written requests for substitution considered:
 - 1. After award of Contract
 - 2. Only when submitted through Contractor
- C. Substitutions will not be considered when they are indicated or implied on shop Drawing or product data submissions, without separate written request
- D. Substitutions may be considered when a Product becomes unavailable through no fault of Contractor:
 - 1. Should the Contractor demonstrate to satisfaction of Engineer that specified material or product was ordered in a timely manner and will not be available in time for incorporation into this Work, Contractor shall submit to Engineer such data on proposed substitute materials and/or product as are needed to help Engineer determine suitability of proposed Substitution
- E. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents
- F. A request constitutes a representation that Contractor:
 - 1. Investigated proposed product and determined that it meets or exceeds quality level of specified product and that it will perform function for which it is intended
 - 2. Will provide same warranty for Substitution as for specified Product
 - 3. Will coordinate installation and make changes to other Work which may be required for Work to be complete with no additional cost to Owner

4. Will provide a complete operating installation including any and all changes and additions in structure, piping, building, mechanical and electrical work, controls and accessories necessary to accommodate proposed Substitution
5. Waives claims for additional costs or time extension which may subsequently become apparent
6. Will reimburse Owner for review or redesign services associated with review by Engineer and re-approval by authorities in excess of \$1,000

1.6 PROCEDURE FOR REQUESTING SUBSTITUTION

- A. Submit three copies of request for substitution for consideration in a manner similar to provisions for submission requirements under Section 01340:
 1. Substitutions will be considered as "deviations" to the Contract Documents
 2. Submit with transmittal letter describing the deviation and justifications for accepting Substitution
 3. Submit shop drawings, product data, and certified test results attesting to proposed substitution equivalence
 4. Burden of proof is on the proposer
- B. Limit each request to one proposed Substitution
- C. Transmittal Contents:
 1. Identification of proposed Substitution:
 - a. Manufacturer's name
 - b. Telephone number and representative contact name
 - c. Specification section or drawing reference of originally specified product including discrete name or tag number
 2. Manufacturer's literature clearly marked to show compliance of proposed Substitution with Contract Documents
 3. Itemized comparison of original product and proposed Substitution addressing characteristics including but not necessarily limited to:
 - a. Size
 - b. Composition
 - c. Weight
 - d. Electrical or mechanical requirements
 - e. Installation and maintenance requirements
 4. Product experience:
 - a. Location of previous projects utilizing product in similar situation per Contract Documents
 - b. Name and telephone number of persons knowledgeable of proposed product associated with referenced projects
 - c. Available field data and test reports associated with proposed product
 5. Identify any changes to construction schedule or cost required to implement proposed substitution

6. Samples:
 - a. Provide in similar manner under provisions of Section 01340 as requested by Engineer
 - b. Provide full size sample if requested by Engineer
 - c. Samples will be retained by Engineer until substantial completion
 - d. Engineer is not responsible for loss or damage to samples

1.7 ACCEPTANCE OR REJECTION

- A. Engineer will notify Contractor in writing of decision to accept or reject request for Substitution:
 1. Decision of Engineer is final
 2. Engineer will affix stamp and indicate acceptance of Substitution with a stamp similar to the following:

ACCEPTED SUBSTITUTION
This review was performed for general conformance with the design concept of the project and general compliance with the contract documents based on information provided by the contractor. Acceptance by engineer does not relieve contractor from responsibility for providing a complete operating installation including any and all changes and additions necessary to accommodate the substitution. Contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences, and procedures of construction; coordination of the work of all trades; and for performing all work in a safe and satisfactory manner.
Farr West Engineering
Date _____ By _____

- B. Engineer reserves the right to require proposed Substitution to comply with all aspects of specified product to secure design intent
- C. If request for Substitution results in change of Contract Amount or Contract Time, adjustments will be applied under provisions in General Conditions
- D. Substitutions will be rejected if:
 1. Submission is not through Contractor with Contractor stamp of approval
 2. Requests for Substitution are not made in accordance submission procedures outlined herein
 3. Acceptance will require substantial revision of the original design as determined by Engineer
 4. Substitution is not equal to original product specified or will not adequately perform intended function as determined by Engineer

1.8 REIMBURSEMENT OF SUBSTITUTION REVIEW COSTS

- A. In the event Substitutions are proposed to Engineer after award of Contract, Engineer will record all time used by Engineer and Engineer's consultants in evaluating each proposed Substitution
- B. Contractor shall reimburse Owner for all charges in excess of \$1,000 of Engineer and Engineer's consultants for time spent in evaluating proposed Substitution, whether or not the Engineer approves a proposed Substitution:
 - 1. Costs in excess of \$1,000 for substitution review will be deducted from payments due Contractor as change order deducts
 - 2. Charges for review of proposed Substitution will include Engineer at maximum rate of \$110 per hour plus costs of Engineer's consultants

1.9 DELAYS

- A. Delays in construction arising by virtue of the nonavailability of a specified material and/or product will not be considered by the Engineer as justifying an extension of the agreed time of Substantial and/or Final Completion

END OF SECTION

SECTION 01631
REQUEST FOR SUBSTITUTION

PROJECT: _____

OWNER: _____

TO: _____

SPECIFIED ITEM: _____

Section	Page	Paragraph/Article	Description
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The Contractor hereby requests consideration of the following:

PROPOSED SUBSTITUTION: _____

Attached data includes product description, specifications, drawings, photographs, performance, and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Contractor certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on Drawings.
2. The Contractor will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The Contractor further states that the function, appearance, and quality of the proposed substitution are equivalent or

Submitted by: Signature: _____ Firm _____ Address _____ _____ Date _____ Telephone _____	For use by the Engineer <table style="width: 100%;"><tr><td>☐ Accepted As Submitted</td><td>☐ Exceptions Noted</td></tr><tr><td>☐ Rejected</td><td>☐ Received too late</td></tr></table> By _____ Date _____ Remarks _____	☐ Accepted As Submitted	☐ Exceptions Noted	☐ Rejected	☐ Received too late
☐ Accepted As Submitted	☐ Exceptions Noted				
☐ Rejected	☐ Received too late				
Attachments					

SECTION 01700
CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures
- B. Final cleaning
- C. Adjusting
- D. Contractor's closeout submittals
- E. Warranties
- F. Spare parts
- G. Delivery to Owner
- H. Substantial completion
- I. Final inspection
- J. Reinspection fees
- K. Final adjustments of accounts
- L. Final application for payment

1.2 RELATED SECTIONS

- A. Section 01500—Construction Facilities and Temporary Controls
- B. Section 01710—Cleaning
- C. Section 01720—Project Record Documents

1.3 CLOSEOUT PROCEDURES

- A. Comply with requirements stated in conditions of the Contract and in specifications for administrative procedures in closing out the Work

- B. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection
 - C. Provide submittals to Engineer/Owner that are required by governing or other authorities
- 1.4 FINAL CLEANING
- A. Provide final cleaning under provisions of Section 01710
 - B. Execute final cleaning prior to final inspection
 - C. Remove waste and surplus materials, rubbish, and construction facilities from the site
- 1.5 ADJUSTING
- A. Provide under provisions of Section 01650
 - B. Adjusting operating Products and equipment to ensure smooth and unhindered operation
- 1.6 CONTRACTOR'S CLOSEOUT SUBMITTALS
- A. Project record documents
 - B. Spare parts and maintenance materials: As specified in individual sections and as specified herein
 - C. At Contract close-out, deliver Record Documents according to Section 1720 to Engineer for the Owner
 - D. Accompany submittal with transmittal letter in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name and address
 - 4. Title and number of each Record Document
 - 5. Signature of Contractor or his authorized representative
- 1.7 WARRANTIES
- A. Provide duplicate notarized copies

- B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers
 - C. Provide Table of Contents and assemble in three "D" side ring binder with durable plastic cover
 - D. Submit prior to final Application for Payment
 - E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period
- 1.8 SPARE PARTS AND MAINTENANCE MATERIALS
- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections
 - B. Deliver to Project site; obtain receipt prior to final payment
 - C. Store the items in a clean, dry, storage shed or bonded warehouse
 - D. Protect all items from damage during storage. Store in sturdy boxes or crates with lid
- 1.9 DELIVERY TO OWNER
- A. At or prior to time of inspection for Substantial Completion deliver all required items to Owner at place on site designated by Owner:
 - 1. Contractor and representatives of Owner and Engineer shall inspect and inventory all items delivered
 - B. Submit to Engineer detailed itemized summary of all items delivered:
 - 1. Organize summary by specification sections
 - 2. Indicate on summary any items delivered which were damaged or defective
 - 3. Contractor and Owner's and Engineer's representatives shall sign summary certifying that all items listed were delivered and that, unless otherwise noted on summary, all items were in good condition at time of delivery to Owner
 - C. Engineer will review summary for completeness and inform Contractor promptly of any deficiencies therein
 - D. Contractor shall deliver all additional items identified by Engineer and replace all damaged and defective items noted on original summary before requesting final inspection
 - E. Summary for additional and replacement items, signed by Contractor and Owner's and Engineer's representatives, shall be submitted

1.10 SUBSTANTIAL COMPLETION

- A. When Contractor considers the Work is substantially complete, he shall submit to Engineer:
 - 1. A written notice that the Work or designated portion thereof is substantially complete
 - 2. A list of items to be completed or corrected
- B. Within reasonable time after receipt of such notice, Engineer will make an inspection to determine status of completion
- C. Should Engineer determine that the Work is not substantially complete:
 - 1. Engineer will promptly notify Contractor in writing, giving reasons therefore
 - 2. Contractor shall remedy deficiencies in the Work and send second written notice of Substantial Completion to Engineer
 - 3. Engineer will reinspect the Work
- D. When Engineer finds that the Work is substantially complete, he will:
 - 1. Prepare and deliver to Owner tentative Certificate of Substantial Completion with tentative list of items to be completed or corrected before final payment
 - 2. After consideration of any objections made by Owner as provided in Conditions of the Contract and when Engineer considers the Work substantially complete, he will execute and deliver to Owner and Contractor definite Certificate of Substantial Completion with revised tentative list of items to be completed or corrected
- E. No Certificate of Substantial Completion will be issued by Engineer until detailed itemized summary is submitted for review
- F. Final payment will not be made until all specified spare parts, maintenance materials, and special tools have been delivered to Owner in acceptable condition

1.11 FINAL INSPECTION

- A. When Contractor considers the Work is complete, Contractor shall submit written certification that:
 - 1. Contract Documents have been reviewed
 - 2. Work has been inspected for compliance with Contract Documents
 - 3. Work has been completed in accordance with Contract Documents
 - 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational
 - 5. Work is completed and ready for final inspection
- B. Engineer and Consultant will make an inspection to verify status of completion with reasonable promptness after receipt of such certification
- C. Should Engineer consider that the Work is incomplete or defective:

1. Engineer will promptly notify Contractor in writing listing incomplete or defective work
 2. Contractor shall take immediate steps to remedy stated deficiencies and send second written certification to Engineer that the Work is complete
 3. Engineer will reinspect Work
- D. When Engineer finds that the Work is acceptable under Contract Documents, Engineer shall request Contractor to make closeout submittals
- 1.12 REINSPECTION FEES
- A. Should Engineer and Consultant perform reinspections due to failure of the Work to comply with claims of status of completion made by Contractor:
1. Owner will compensate Engineer for such additional services of Consultant
 2. Owner will deduct amount of such compensation from final payment to Contractor

END OF SECTION

SECTION 01710

CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hazards and governing control
- B. Cleaning materials
- C. General work area conditions during construction
- D. Interior and exterior (site) cleaning

1.2 RELATED SECTIONS

- A. Division 1—General Requirements
- B. Cleaning of certain parts of the work described in various sections of the specifications

1.3 STORAGE AND HANDLING

- A. Store cleaning products and cleaning wastes in containers specifically designed for those materials

1.4 SCHEDULING

- A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process will not fall on newly painted surfaces

1.5 HAZARDS AND GOVERNING CONTROL

- A. Hazards Control:
 - 1. Store volatile wastes in covered metal containers and remove from premises daily
 - 2. Prevent accumulation of wastes which create hazardous conditions
 - 3. Provide adequate ventilation during use of volatile or noxious substances
- B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities including anti-pollution laws:
 - 1. Do not burn or bury rubbish and waste materials on project site
 - 2. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

- A. Cleaning Agents:
 - 1. Use cleaning materials only on surfaces recommended by cleaning material manufacturer
 - 2. New and uncontaminated
- B. Use only cleaning materials recommended by manufacturer of surface to be cleaned

PART 3 EXECUTION

3.1 GENERAL WORK AREAS DURING CONSTRUCTION

- A. Follow applicable MSHA regulations
- B. Maintain premises free from accumulations of waste and debris caused by work on this project
- C. Prevent dust nuisance attributable to this work
- D. Do not drop or throw materials from heights greater than 4 foot or less than 4 foot if conditions warrant greater care
- E. Handle materials in a controlled manner with as few handlings as possible
- F. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on newly painted surfaces
- G. Dispose of degradable debris at an approved solid waste disposal site
- H. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies
- I. Repair, patch, and touch-up marred surfaces to specified finish to match adjacent surfaces
- J. On completion of work, leave area in a clean, natural looking condition. Remove all signs of temporary construction and activities incidental to construction of required permanent Work

3.2 INTERIOR CLEANING

- A. Cleaning During Construction:
 - 1. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations
 - 2. At maximum weekly intervals, dispose of waste materials, debris, and rubbish

3. Vacuum clean interior areas when ready to receive finish painting. Continue vacuum cleaning on an as-needed basis, until substantial completion
4. Vacuum clean interior spaces, including inside cabinets
5. Control dust in work areas of existing facilities:
 - a. Provide protection to existing electrical and mechanical equipment as required to eliminate detrimental effects due to construction
 - b. Check air handling filters in existing units having construction activities. Weekly replace as necessary
 - c. Check interior of existing electric panels and vacuum if dust accumulation has occurred at maximum monthly intervals
 - d. Sweep all floors, including basins, tunnels, platforms, walkways, and pick up and dispose of all debris at maximum weekly intervals. Use dust suppressant sweeping compound in areas open to areas of existing facility operations

B. Final Cleaning:

1. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces
2. Wipe all lighting fixture reflectors, lenses, lamps and trims clean
3. Wash and shine glazing and mirrors
4. Polish glossy surfaces to a shine finish
5. Ventilating systems:
 - a. Clean permanent filters and replace disposable filters if units were operated during construction
 - b. Clean ducts, blowers and coils if units were operated without filters during construction
6. Replace all burned out lamps
7. Broom clean process area floors
8. Mop office and control room floors

3.3 EXTERIOR (SITE) CLEANING

A. Cleaning During Construction:

1. Construction debris:
 - a. Confine in strategically located container(s) covered to prevent blowing by wind
 - b. Remove from work area to container daily
 - c. Haul from site once a week (minimum)
2. Vegetation: Keep weeds and other vegetation trimmed to 3 inch maximum height
3. Remove soils, sand, and gravel deposited on paved areas and walks as required to prevent muddy or dusty conditions:
 - a. Do not flush into storm sewer system
4. Comply with stormwater general permit requirements, and monitor and employ best management practices (BMP)

B. Final Cleaning:

1. Remove trash and debris containers from site:
 - a. Re-seed areas disturbed by location of trash and debris containers
2. Broom clean paved surfaces
3. Rake clean other surfaces of grounds

3.4 FIELD QUALITY CONTROL

- A. During substantial completion walk thru or prior to start-up, conduct an inspection with Engineer to verify acceptable condition of all work areas

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Maintenance of record documents. Throughout progress of Work, maintain an accurate record of changes in the Contract Documents, and, upon completion of Work, transfer recorded changes to set of Record Documents

1.2 RELATED SECTIONS

- A. Include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications
- B. Individual sections of Technical Specifications

1.3 SUBMITTALS

- A. Comply with pertinent provisions under Section 01340
- B. Prior to submitting request for final payment, submit the final Project Record Documents to Engineer for acceptance

PART 2 PRODUCTS

2.1 RECORD DOCUMENTS

- A. Job set: Promptly following receipt of Owner's Notice to Proceed, secure from Engineer at no charge to Contractor one complete set of all Documents comprising the Contract
- B. Final Record Documents: At a time nearing the completion of the Work, secure from Engineer at no charge to Contractor one complete set of blueline copies of all Drawings in the Contract

PART 3 EXECUTION

3.1 MAINTENANCE OF JOB SET

- A. Immediately upon receipt of job set, identify each of the Documents with the title, "RECORD DOCUMENTS—JOB SET"
- B. Preservation:
 - 1. Devise a suitable method for protecting job set

- C. Making entries on Drawings:
 - 1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required
 - 2. Date all entries
 - 3. Call attention to the entry by a "cloud" drawn around the area or areas affected
 - 4. In the event of overlapping changes, use different colors for the overlapping changes
- D. Make entries in pertinent other Documents accepted by Engineer
- E. Conversion of schematic layouts:
 - 1. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, is shown schematically and is not intended to portray precise physical layout:
 - a. Final physical arrangement is determined by Contractor, subject to Engineer's acceptance
 - b. However, design of future modifications of the facility may require accurate information as to the final physical layout of items which are shown only schematically on the Drawings
 - 2. Show on the job set of Record Drawings, by dimension accurate to within one inch for interior installations and one foot for exterior installations, the centerline of each run of items described above:
 - a. Clearly identify the item by accurate note such as "cast iron drain," "galv. water," and the like
 - b. Show, by symbol or note, the vertical location of the item ("under slab," "in ceiling plenum," "exposed," and the like)
 - c. Make all identification so descriptive that it may be related reliably to the Specifications
 - 3. Engineer may waive the requirements for conversion of schematic layouts where, in Engineer's judgment, conversion serves no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by Engineer

3.2 FINAL PROJECT RECORD DOCUMENTS

- A. The purpose of final Project Record Documents is to provide factual information regarding all aspects of Work, both concealed and visible, to enable future modification of Work to proceed without lengthy and expensive site measurement, investigation, and examination
- B. Transfer of data to Drawings:
 - 1. Carefully transfer change data shown on Job Set of Record Drawings to the corresponding bluelines, coordinating the changes as required
 - 2. Clearly indicate at each affected detail and other Drawing, a full description of changes made during construction, and the actual location of items to be located
 - 3. Call attention to each entry by drawing a "cloud" around the area or areas affected

4. Make changes neatly, consistently, and with the proper media to assure longevity and legibility
- C. Transfer of data to other Documents:
1. If Documents other than Drawings have been kept clean during progress of Work, and if entries thereon have been orderly and acceptable to Engineer, the job set of those Documents other than Drawings will be accepted as final Record Documents
 2. If any such Document is not acceptable to Engineer, secure a new copy of that Document from the Engineer at Engineer's usual charge for reproduction and handling, and carefully transfer the changed data to the new copy for acceptance by Engineer
- D. Review and submittal:
1. Submit completed set of Project Record Documents to Engineer as described above and under provisions of Section 01340
 2. Participate in review meetings as required
 3. Make required changes and promptly deliver final Project Record Documents to Engineer
- 3.3 CHANGES SUBSEQUENT TO ACCEPTANCE .
- A. Contractor has no responsibility for recording changes in Work subsequent to Final Completion, except for changes resulting from Warranty work

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.1 DESCRIPTION

- A. Clearing, grubbing, and site preparation
- B. Removal and disposal of debris
- C. Handling, storage, transportation, and disposal of excavated material
- D. Sheeting, shoring, bracing, and protection work
- E. Pumping and dewatering as required or necessary
- F. Backfilling
- G. Pipe embedment
- H. Construction of fills and embankments
- I. Trench Stabilization
- J. Final grading
- K. Slope Stabilization
- L. Erosion Control [and Stormwater Management Plan]
- M. Appurtenant work

1.2 RELATED SECTIONS

- A. Section 03000—Concrete

1.3 REFERENCES

- A. ASTM C33—Concrete Aggregates
- B. ASTM C136—Sieve Analysis of Fine and Coarse Aggregates

- C. ASTM D1241—Material for Soil Aggregate Subbase, Base, and Surface Courses
- D. ASTM D1557—Test Methods for Moisture—Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb Rammer and 18-inch drop
- E. ASTM D4253—Test Methods for Maximum Index Density of Soils Using a Vibratory Table
- F. ASTM D4254—Test Methods for Minimum Index Density of Soils and Calculations of Relative Density
- G. ASTM D2922—Test Methods for Density of Soil and Soil-Aggregate Mixtures in Place by Nuclear Methods (Shallow Depth)
- H. ASTM D3017—Test Method for Moisture Content of Soil and Soil-Aggregate Mixtures

1.4 SUBMITTALS

- A. Submit under provisions of Section 01340
- B. Product Data: Submit on all products or materials supplied herein
- C. Test Reports: Indicate sieve analysis, optimum moisture content and density in accord and with ASTM D698 for cohesive soils including onsite native material. Indicate supplier, sieve analysis, and maximum relative density in accord with ASTM D4253 and D4254 for crushed rock or gravel, pipe embedment and other cohesionless material for fills and embankment

1.5 REGULATORY REQUIREMENTS

- A. Comply with all requirements of State and/or County Erosion Control Permit, and State Construction Dewatering Permit

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling
- B. Protect work from erosion or other similar types of damage until the project has been completed
- C. Do not backfill or construct fills during freezing weather. Backfill or construct fills only when temperature is 35 degrees F and rising
- D. Do not use frozen materials, snow, or ice in any backfill or fill area
- E. Do not backfill or construct fill on frozen surfaces

- F. Protect excavated material from becoming frozen
- G. Provide temporary bridges for roadways, walkways, driveways, etc.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Classification of Excavated Materials:
 - 1. None
 - 2. Remove and handle excavated materials regardless of type, character, composition, condition, or depth of material at no additional cost to Owner
 - 3. Remove and handle excavated materials regardless of means, methods, and techniques required, at no additional cost to Owner
- B. Fills and Embankments:
 - 1. To the max extent practical use excess earth from excavation for fills and embankments
 - 2. Obtain additional material from borrow areas as necessary
 - 3. Free from rocks or stones larger than 8 inch in greatest dimension and free from brush, stumps, logs, roots, debris, and organic and other deleterious materials
 - 4. Fill and embankment material acceptable to Engineer
 - 5. No rocks or stones greater than 3 inch in upper 6 inch of fill or embankment
 - 6. Where allowed, distribute rocks and stones through the fill to not interfere with compaction
 - 7. Crushed rock or gravel: Graded 12 inch to No. 4, ASTM C33, free of dust, clay or trash
- C. Topsoil:
 - 1. Native material removed and stockpiled before excavation
 - 2. Free from trash, debris, surface vegetation more than 6 inch high
- D. Pipe Bedding Sand: Crushed graded gravel
 - 1. Per plan set notes and details.
 - 2. Finely divided site excavated material free from debris, clay lumps, organic material and stones larger than 2 inches in greatest dimension
- E. Compacted Trench Backfill:
 - 1. Job excavated material finely divided, free of debris, organic material, and stones larger than 3 inch in greatest dimension without masses of moist, stiff clay.
 - 2. Graded gravel: As specified for pipe embedment
- F. Trench Cover:
 - 1. Free of brush, debris and roots
 - 2. May contain rubble and detritus from rock excavation, stones and boulders if well separated and arranged not to interfere with backfill settlement
 - 3. In upper 6 inch no rock or rock excavated detritus

4. No stones larger than 8 inch in greatest dimension

G. Structural Fill

1. Earth only, free of wood, grass, roots, broken concrete, stones, trash, or debris of any kind
2. Moisture content uniformly distributed and such that max density of compacted soil will be obtained
3. Gravel Base to comply with following gradations:

Sieve Size (Inch)	Percent Passing by Weight
1 1/4	100
#4	50 maximum
#200	5 maximum

2.2 ACCESSORIES

- A. Straw bales used for erosion control barriers: Wire or string wound and less than one year old. Do not use bales in an advanced state of deterioration regardless of age
- B. Stakes for erosion control bales: No. 4 reinforcing steel or 2-inch by 2-inch wood stakes
- C. Erosion Control Fabric: Straw or coconut fiber combination blanket for temporary protection of steep sloped areas:
 1. "S-2" as manufactured by Bon Terra America
 2. "S150" as manufactured by North American Green
 3. Or approved equal
- D. Silt Fence Fabric: Woven polypropylene:
 1. Mirafi 100X for "Envirofence" installations
 2. Or approved equal

PART 3 EXECUTION

3.1 EXAMINATION

- A. Field verify the location of all underground utilities, pipelines and structures prior to excavation

3.2 PERFORMANCE—GENERAL

- A. Perform work in a safe and proper manner with appropriate precautions against hazard
- B. Provide adequate working space and clearances for work performed within excavations and for installation and removal of concrete forms
- C. Do not undercut excavation faces for extended footings

- D. Clean subgrades of loose material before concrete is placed thereon
- E. Except as otherwise authorized, indicated, or specified, replace all material excavated below the bottom of concrete walls, footings, slabs on grade and foundations with concrete placed at the same time and monolithic with the concrete above
- F. Except where exterior surfaces are to be damp-proofed concrete structures that do not have footings that extend beyond the outside face of exterior walls may be placed directly against excavation faces without outer forms

3.3 PREPARATION

- A. Clear sites to be occupied by permanent construction of roots, brush, and other objectionable material and debris
- B. Clean and strip subgrade for fills and embankments of surface vegetation, sod, tree stumps and organic topsoil
- C. Remove waste materials from site and dispose
- D. Preparation of right of ways-clean, as necessary, for access, stringing of pipeline materials and construction of pipelines and appurtenant structures
- E. Remove debris, all trees, underbrush, stumps, roots and other combustible materials from site daily and dispose of off-site; on-site burning is not permitted

3.4 TOPSOIL

- A. Remove and stockpile sufficient topsoil to surface to a minimum depth of 4 inches fill, embankment and other areas where the original topsoil will be covered or damaged
- B. At the completion of other work in each area, place and grade topsoil to maintain gradient as indicated

3.5 DEWATERING

- A. Provide and maintain adequate dewatering equipment to remove and dispose of surface and groundwater entering excavations, trenches, and other parts of the work
- B. Keep each excavation dry during subgrade preparation and continually thereafter until the structure to be built or the pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result
- C. Dewater excavations which extend to or below groundwater by lowering and keeping the groundwater level beneath such excavation at least 12 inches below the bottom of the excavation

- D. Divert surface water or otherwise prevent it from entering excavated areas or trenches to the extent practical without damaging adjacent property
- E. Maintain all drainage pipes, keep clean and free of sediment during construction and final cleanup
- F. Consult with Owner's Representative for dewatering recommendations

3.6 SHEETING, SHORING AND BRACING

- A. Provide proper and substantial sheeting, shoring, and bracing, as required, to prevent caving or sliding, to protect workmen and the Work, and to protect existing structures and facilities
- B. Design and build sheeting, shoring, and bracing to withstand all loads that might be caused by earth movement or pressure, and to be rigid, maintaining shape and position under all circumstances
- C. Do not pull trench sheeting before backfilling unless pipe strength is sufficient, to carry trench loads based on trench width to the back of sheeting
- D. Do not brace sheeting left in place against the pipe, but support it in a manner that precludes concentrated loads or horizontal thrusts on pipe
- E. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment is completed

3.7 TRENCH STABILIZATION

- A. Thoroughly compact and consolidate subgrades for concrete structures, precast structures, and utility trench bottoms so they remain firm, dense and intact during required construction activities
- B. Remove all mud and muck during excavation
- C. Reinforce subgrades with crushed rock or gravel if they become mucky during construction activities
- D. Finished elevation of stabilized subgrades are to be at or below subgrade elevations indicated on Drawings
- E. Allow no more than 2-inch depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon

3.8 CRUSHED ROCK OR GRAVEL FILLS

- A. Place on suitably prepared and compacted subgrade
- B. Compacted by vibration

3.9 ROADWAY EXCAVATION AND SUBGRADE PREPARATION

- A. Excavate for roadways, drives, and parking areas per the lines and dimensions indicated on Drawings
- B. Excavate unsuitable material from the subgrade
- C. After shaping, roll subgrade compacted to 95 percent of max density within ± 2 percent optimum moisture content, ASTM D1557, to a minimum depth of 12 inch
- D. Reshape and wet as required
- E. Remove soft or otherwise unsuitable material, and replace with suitable material

3.10 BUILDING EXCAVATION

- A. Excavate subsoil required to accommodate building foundations and slabs on grade
- B. Machine slope banks to stable configuration
- C. Grade top perimeter of excavation to prevent surface water from draining into excavation
- D. Do not overexcavate and minimize extent of excavation where possible
- E. Correct areas overexcavated with suitable on-site material or gravel fill

3.11 FILLS AND EMBANKMENTS

- A. Level and roll subgrade so surface materials will be compact and bond with the first layer of fill or embankment
- B. Place in horizontal layers 8-inch max uncompacted depth
- C. Spread and level material deposited in piles and windrows before compacting
- D. Thoroughly compact each layer by rolling or other means acceptable to Engineer to 95 percent of max density within ± 2 percent optimum moisture content, ASTM D1557
- E. Alter compaction methods if material fails to meet specified density
- F. Where a trench passes through a fill or embankment, place and compact fill or embankment to 12 inch above the top of the pipe before excavating the trench
- G. Add water and harrow, disc, blade, or otherwise work each layer to obtain the uniform moisture content and adequate compaction

3.12 BORROW AREA

- A. Obtain material required to complete fills and embankments as directed by Engineer
- B. Final grade disturbed areas of borrow to uniform slope
- C. Use material free of debris and deleterious material

3.13 BLASTING

- A. Not allowed except through Owner

3.14 TRENCH EXCAVATION

- A. Establish alignment and grade or elevation from offset stakes
- B. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations indicated on the Drawings
- C. Comply with pipe specification sections regarding vertical and horizontal alignment and max joint deflection
- D. Where grades or elevations are not fixed on the Drawings, excavate trenches to provide a minimum depth of backfill cover over the top of pipe:

1. 60 inches for water piping
 2. Increase depth as required at vertical curves and for clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades
- E. Measure pipe cover depth vertically from top of pipe to finished ground or surface elevation
- F. Do not open more trench in advance of pipe laying than is necessary to expedite the work.
- G. Except where tunneling is indicated on the Drawings, specified, or permitted by Engineer, excavate trenches by open cut from the surface
- H. Limiting trench widths:
1. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, embedment
 2. If needed to reduce earth loads to prevent sliding, cut banks back on slopes which extend not lower than 1 foot above the top of the pipe
 3. Stipulated minimum clearances are minimum clear distances, not minimum average distances
 4. Max trench width from 6 inch above the top of pipe to trench bottom of the installed pipe: Pipe O.D. plus 12 inches
 5. Limit trench widths and permissible clearances from 6 inches above top of pipe to trench bottom for installed pressure and non-pressure piping
- I. If the width of the lower portion of the trench exceeds the max permitted, provide pipe of adequate strength, special pipe embedment, or arch concrete encasement as required by loading conditions and as determined by Engineer
- J. Mechanical excavation:
1. Do not use where its operation would damage buildings, culverts, or other existing property, structures, or utilities above or below ground; hand excavate only in such areas
 2. Use mechanical equipment of a type, design, and construction and operated so that:
 - a. Rough trench bottom elevation can be controlled
 - b. Uniform trench widths and vertical sidewalls are obtained from 1 foot above the top of the installed pipe to the bottom of the trench
 - c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls
 3. Do not undercut trench sidewalls
 4. Recompect trench bottom disturbed by bucket teeth prior to placement of embedment material

- K. Except as otherwise required, excavate trenches below the underside of pipes as indicated in the Drawings to provide for installation of granular embedment pipe foundation material
- L. Trench bottoms may be excavated below pipe subgrade and granular embedment provided or the trench may be graded to provide uniform and continuous support (between bell holes or end joints) of the installed pipe, Contractor's option
- M. Whenever so directed by Engineer, excavate to such depth below grade as Engineer directs and bring the trench bottom to grade with such material as Engineer may direct
- N. Provide concrete, or other foundations made necessary by unstable soil as directed by Engineer
- O. Excavate to provide adequate clearance for tools and methods of pipe installation
- P. Cuts in surface construction:
 - 1. Do not undercut trenches, resulting in bottom trench width greater than top widths
 - 2. Where the trench parallels the length of a concrete walk which is all or partially over the trench, remove and replace the entire walk
 - 3. Where the trench crosses drives, walks, curbs, or other surface construction, remove and replace the surface construction between saw cuts

3.15 PIPE EMBEDMENT

- A. Embed pipes above and below the bottom of pipe as indicated in the Drawings and as specified
- B. Spread and surface grade granular embedment to provide continuous and uniform support beneath pipe at all points between pipe joints
- C. After grading, aligning, and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe and to hold the pipe in proper position and alignment during subsequent operations
- D. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent lateral displacement

- E. Granular embedment:
 - 1. Compact by slicing with shovel or vibrating
 - 2. Maximum lift height 6 inch
- F. Compacted embedment:
 - 1. Maximum lift height 8 inch
 - 2. Compact to 95 percent max density as determined by ASTM D1557

3.16 TRENCH BACKFILL

- A. Compacted backfill:
 - 1. For full depth of trench above embedment
 - 2. Beneath roadways, surfacing, gutters, walks or other surface construction or structures
 - 3. Beneath fills and embankments
- B. Where the trench for a pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench
- C. Place job excavated materials in 8-inch max uncompacted thickness, uniform layers
- D. Increased layer thickness may be permitted for uncohesive material if Contractor demonstrates to Engineer's satisfaction that specified compacted density will be achieved
- E. Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe
- F. Compact to 95 percent of max density within ± 2 percent optimum moisture content per ASTM D1557 or to an equivalent percent relative density per ASTM D4253/D4254 when appropriate

3.17 STRUCTURAL BACKFILL

- A. Maximum lift height 6 inches
- B. Compact with mechanical, platform-type tampers
- C. Minimum density of 95 percent within ± 2 percent optimum moisture content as determined by ASTM D1557
- D. Use roller for compaction if necessary to prevent damage to structure and desired density can be obtained
- E. Compaction by inundation by water not permitted
- F. If trench passes through a structure backfill, compact backfill to an elevation of 12 inches above top of pipe before trenching

- G. Do not deposit or compact tamped or otherwise mechanically compacted backfill in water
- H. Take particular care to compact backfill which will be beneath slabs, pipes, drives, roads, parking areas, curb, gutters or other surface construction

3.18 DRAINAGE MAINTENANCE

- A. Do not backfill trenches across roadways, drives, walks or other trafficways adjacent to drainage ditches or water courses prior to backfilling the trench on the upstream side of the trafficway to prevent impounding water after pipe is laid
- B. Backfill so that water does not accumulate in unfilled or partially filled trenches
- C. Remove materials deposited in roadway ditches or other water courses crossed by the trench line immediately after backfilling is completed and restore ditches and water courses to original section, grade, and contours
- D. Do not obstruct surface drainage any longer than necessary
- E. Provide and maintain temporary bridges and other structures across unfilled trenches as required to maintain traffic

3.19 DISPOSAL OF EXCESS EXCAVATED MATERIALS

- A. Use excess excavated materials in fills and embankments as indicated on the Drawings to the extent needed
- B. Dispose of suitable excess excavated materials at locations on the site directed by Engineer
- C. Remove debris, junk, broken concrete, broken asphalt, rock, stones, stumps, logs, roots, and other unsuitable material from the site and dispose of it
- D. Except as otherwise permitted, dispose of excess excavated materials away from the site of the Work or as directed by Owner
- E. Distribute excess earth from excavations located in unimproved property directly over the pipe trench and within the pipeline right-of-way to a max depth of 6 inch above the original ground surface elevation at and across the trench and sloping uniformly each way:
 - 1. Carefully finish material thus wasted with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point

3.20 FINAL GRADING

- A. After completion of all other outside work and after backfilling is completed and settled, bring to grade all areas of the site to be graded
 - B. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand work
 - C. Grade all surfaces for effective drainage
 - D. Provide a 2 percent minimum slope except as otherwise required
 - E. Grade and surface to maintain gradient as indicated
- 3.21 STRAW BALE EROSION CONTROL BARRIERS
- A. Place straw bale erosion control barriers where required and where directed by the Engineer
 - B. Field locate straw bales along slopes, next to water courses and downstream of disturbed areas to prevent surface runoff from eroding areas disturbed by Contractor during construction, to minimize the transport of suspended solids downstream or into adjacent streams, canals or ditches and to protect newly seeded areas
 - C. Install each bale with wire binding oriented around the bale rather than on top of the bale. Stake each bale twice with reinforcing steel or wood stakes deep enough into the ground to securely anchor the bale
 - D. Maintain and replace bales as required for an effective erosion control barrier until satisfactory uniform plant growth is established as defined herein
- 3.22 FIELD QUALITY CONTROL
- A. Provide under provisions of Section 01400
 - B. Coordinate and pay for all tests to determine compliance of in-place and backfill materials and compaction in accordance with the specifications
 - C. Pipe Embedment and Backfill:
 - 1. Two initial gradation tests for each type of material
 - 2. Two moisture-density relationship tests, ASTM D1557, or 2 relative density tests, ASTM D4253/D4254, as appropriate for each type of embedment on backfill material proposed, except granular embedment material
 - 3. One in-place compaction test near top of trench for trench depth of 2 feet or less, ASTM D2922/D3017
 - 4. Two (2) additional in-place compaction tests at the discretion of the Engineer, ASTM D2922/D3017

END OF SECTION

SECTION 02220
WATER WELL

PART 1 GENERAL

Installation shall be in accordance with a design and plan approved by the responsible technician. Details of construction shown in the design and plan or described in the State Regulations, not included, shall be considered as a part of this specification. Construction activities shall be in accordance with applicable OSHA regulations.

1.1 RELATED SECTIONS

- A. Section 11306—Pumping Plant

1.2 REGULATORY REQUIREMENTS

- A. In accordance with all municipal codes and ordinances, laws and regulations of the state where installation will occur. In case of apparent conflict, state and local requirements govern over these specifications

PART 2 PRODUCTS

2.1 CASING

- A. Steel Pipe
 - 1. Steel pipe used for well casing shall meet or exceed the requirements specified in ASTM A589.
- B. Plastic Pipe
 - 1. Plastic pipe used for well casing shall conform to ASTM F 480. Plastic casings for transporting potable water supplies shall be NSF approved.
- C. Joint Strength
 - 1. Well casing joints shall have adequate strength to carry the load due to the casing length and still be watertight or shall be mechanically supported during installation to maintain joint integrity.
 - 2. Such mechanically supported casings shall terminate on firm material that can adequately support the casing weight.

2.2 SCREEN

- A. A well screen shall be installed in any earth material likely to produce silt or sand. Well screens may be constructed of commercially manufactured screen sections, well points, or field-perforated sections.
- B. Perforation by any method is allowable provided proper slot size and entrance velocity limits can be met. The length and open area of the screen shall be sized to limit entrance

velocity of water into the well to less than or equal to 0.1 foot per second.

- C. Depth of the aquifer below ground surface and the thickness of aquifer to be penetrated by the well shall govern the position of the screen in the well.
- D. Maximum drawdown shall not be permitted below the top of the highest screen or pump intake.
- E. Telescoped screen assemblies shall be provided with one or more sand-tight seals between the top of the telescoped screen assembly and casing.
- F. Installation of a filter pack around the well screen shall be considered under the following conditions:
 - 1. Presence of a poorly graded, fine sand aquifer.
 - 2. Presence of a highly variable aquifer, such as alternating sand and clay layers.
 - 3. Presence of a poorly cemented sandstone or similar aquifer.
 - 4. A requirement for maximum yield from a low-yielding aquifer.
 - 5. Holes drilled by reverse circulation.
- G. For heaving or caving sands, silty or fine-grained aquifers, and for horizontal or angled wells, a commercial prepacked well screen may be substituted for a conventionally installed (by tremie) filter pack.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Borehole
 - 1. Drilled, jetted, bored, and driven wells shall be sufficiently round, straight, and of adequate diameter, to permit satisfactory installation of inlet, well casing, filter pack, and annular seal, and passage of tremie pipe (including couplings), if used.
- B. Use of Casing
 - 1. Casing shall be installed to seal out undesirable surface or shallow ground water and to support the side of the hole through unstable earth materials. The intake portion of a well through stable geologic formations may not require casing. Steel casing shall be used in driven wells.
 - 2. All wells shall be cased to a sufficient height (minimum of 12 inches) above the ground surface to prevent entry of surface and near-surface water.
 - 3. Casing for artesian aquifers shall be sealed into overlying, impermeable formations in such a manner as to retain confining pressure.
 - 4. If a zone is penetrated that is determined or suspected to contain water of quality unsuitable for the intended use, the zone shall be sealed to prevent infiltration of the poor-quality water into the well and the developed portion of the aquifer.

5. Casing shall extend from above the ground surface down through unstable earth materials to an elevation of at least 2 feet into stable material or to the top of the screen.
- C. Casing Diameter
1. Casing diameter shall be sized to permit satisfactory installation and efficient operation of the pump, and large enough to assure that uphole velocity is 5 feet per second or less, to protect against excessive head loss.
- D. Well Development
1. Wells to be completed without a filter pack in unconsolidated granular aquifers shall be developed following guidance provided in ASTM D 5521, Standard Guide for Development of Ground Water Monitoring Wells in Granular Aquifers. The method shall be selected based on geologic character of the aquifer, type of drilling rig, and type of screen.
- E. Aquifer Development
1. For massive, unfractured rock formations unresponsive to well development procedures, the use of aquifer stimulation techniques may be considered to improve well efficiency and specific capacity. Techniques may include dry ice, acidizing, explosives, or hydrofracturing, depending on the composition and structure of the formation.
- F. Grouting and Sealing
1. The annulus surrounding the permanent well casing at the upper terminus of the well shall be filled with expansive hydraulic cement (ASTM C 845), shrinkage-compensating concrete, bentonite-based grout, clay, or other material with similar sealing properties. The length of the grout seal shall be no less than 10 feet and not less than the minimum specified in state or locally applicable construction codes.
 2. If the water is intended for human consumption, the casing shall be surrounded at the ground surface by a 4-inch thick concrete slab extending at least 2 feet in all directions.
 3. A positive seal (grouted in place) or packer shall be provided between the casing and the less pervious material overlying the aquifer of artesian wells, and in all aquifers where co-mingling of waters is undesirable.
- G. Access Port
1. An access port with a minimum diameter of 0.5 inch shall be installed to allow for unobstructed measurement of depth of the water surface, or for a pressure gage for measuring shut-in pressure of a flowing well. Access ports and pressure gages or other openings in the cover shall be sealed or capped to prevent entrance of surface water or foreign material into the well. Removable caps are acceptable as access ports.

H. Disinfection

1. Wells shall be disinfected immediately following their construction or repair to neutralize any contamination from equipment, material, or surface drainage introduced during construction. The disinfection process shall comply with all local or state requirements.

I. Water Quality Testing (If Applicable)

1. Sampling and testing shall comply with all applicable federal, state, and local requirements associated with the intended use(s) of the water.

END OF SECTION