C.O.	Cleanout	Reinf.	Reinforced
Conc.	Concrete	Rem.	Remove
Cond.	Conduit	Rep.	Replace
Corr.	Corrugated	R/W. or	
Cu.	Cubic	R of W	Right-of-Way
Culv.	Culvert	Sani.	Sanitary
Dia.	Diameter	Sq.	Square
Dr.	Drive or Driveway	Std.	Standard
Elev.	Elevation	St.	Street or Storm
F.	Fahrenheit	Str.	Strength
Ft. or '	Foot or Feet	Vol.	Volume
Gal.	Gallon	Yd.	Yard

In reference to such abbreviations as A.S.T.M., A.W.W.A., etc. where a specification number is referred to, the latest revision of said specification shall apply.\

I.40. REFERENCE SPECIFICATIONS

Where reference is made in these specifications to specifications compiled by other agencies, organizations, or departments, such reference is made for expediency and standardization from the material suppliers' point of view, and such specifications referred to are hereby made a part of these specifications.

Whenever reference is made to the furnishing of materials or testing thereof to conform to the Standards of any technical society, organization, or body, it shall be construed to mean the latest standard, code, specification, or tentative specification adopted and published at the time of advertisement for bids, even though reference has been made to an earlier standard, and such standards are made a part hereof to the extent which is indicated or intended.

The following are names and abbreviations of such groups:

AASHO	American Association of State Highway Officials
ACI	American Concrete Institute
AGMA	American Gear Manufacturers Association
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
API	American Petroleum Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASCE	American Society of Civil Engineers
ASA	American Standards Association
ASHE	American Society of Heating & Ventilating Engineers
ASTM	American Society for Testing Materials

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ASME	American Society of Mechanical Engineers
AWSC	American Welding Society Code
AWPA	American Wood Preservers Association
AWWA	American Water Works Association
FED. SPEC.	Federal Specification
NAVY SPEC.	Navy Department Specification
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
SAE	Society of Automotive Engineers Standards
SHBI	Steel Heating Boiler Institute
U.L., INC.	Underwriters' Laboratories, Incorporated

Where no reference is made to a code, standard, or specification, the Standard Specifications of the ASTM, the ASA, the ASME, the AIEE, or the NEMA shall govern.

I.41. INCIDENTAL ITEMS

CONTRACTORS are especially notified that no incidental items of work will be paid for unless there appears an item in the proposal for such work. It must be strictly understood that the prices bid are for complete and acceptable work.

I.42. PUBLIC UTILITIES AND OTHER PROPERTY

In case it is necessary to change or move the property of OWNER or of a public utility, such property shall not be moved or interfered with until ordered to do so by the ENGINEER and OWNER. The right is reserved to the ENGINEER of public utilities to enter upon the limits of the project for the purposed of making such changes or repairs of their property that may be made necessary by performance of this contract.

I.43. USE OF EXPLOSIVES

Use of explosives will not be allowed.

I.44. TOOLS AND ACCESSORIES

The CONTRACTOR shall, unless otherwise stated in the detailed specifications, furnish with each type, kind, or size of equipment, one (1) complete set of suitably marked high grade tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment.

Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

Spare parts shall be furnished as specified in the specific provisions or contract items.

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Each piece of equipment shall be provided with a substantial name plate securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, and principal rating data.

I.45. REFERENCE STANDARDS

Reference to standards, specifications, manuals or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual code, or laws or regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated. However, no provision of any referenced standard, specification, manual, or code, (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of the OWNER, CONTRACTOR, or ENGINEER, or any of their Consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to ENGINEER and OWNER, or any of the their consultants, agents, or employees, any duty or authority to supervise or direct the furnishing or performance of the Work.

I.46. PUBLIC UTILITIES AND OTHER PROPERTY

In case it is necessary to change or move the property of the OWNER or of a public utility, such property shall not be moved or interfered with until authorized by the utility company, OWNER, or ENGINEER.

It will be the CONTRACTOR's responsibility to contact the proper authority, and set up a field meeting to verify by uncovering of the utility and determine the location and elevation of each major utility described above, at least two weeks prior to crossing the utility. If field conditions vary from those shown on the contract plans, the CONTRACTOR shall notify the ENGINEER immediately of field conditions to be encountered, so sufficient time exists to make any necessary adjustments in line or grade. Failure by the CONTRACTOR to make proper and timely verification of the above described utilities shall be justification for rejection of claim for extra cost by the CONTRACTOR.

If, after field verification, it is necessary to change or move the property of a property owner or of a public utility, seven (7) days notice shall be given before such change, and such property shall not be moved or interfered with until authorized by the property owner or the utility company. The right is reserved to the property owner or public utilities to enter upon the limits of the project for the purpose of making such changes or repairs of their property that may be made necessary by the performance of this contract.

I.47. CONSTRUCTION IN PUBLIC ROADS

CONTRACTOR will be responsible for complying with all federal, State, County and City regulations pertaining to construction in public roadway and traffic safety. No public road shall be entirely closed overnight. It shall be the responsibility of the CONTRACTOR to build and maintain all weather bypasses and detours, if necessary, and to properly light, barricade and mark all bypasses and detours that might be required on and across the roads involved in the

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work included in this contract.

The CONTRACTOR shall make every effort to complete construction and allow immediate access to adjacent property at driveway entrances located along the roads. Owners or tenants of improvements where access and/or entrance drives are located shall be notified at least twenty-four (24) hours prior to the time the construction will be started at their drive-ins or entrances, and the CONTRACTOR shall provide temporary ingress to entrance drives where necessary. The CONTRACTOR shall be responsible for all road and entrance reconstruction and repairs and maintenance for same for a period of one year from the date of acceptance of the project.

In addition to roads and entrances cut by construction excavation, if any other roads or streets in the area are used by the CONTRACTOR or Subcontractors during the progress of construction and are damaged by the CONTRACTOR in the opinion of the Engineer, the Contractor, when directed by the OWNER, shall immediately repair such damage. In the event the repairs and maintenance are not made in a reasonable period of time and it becomes necessary for the County, City, OWNER or ENGINEER to make such repairs, the CONTRACTOR shall reimburse the County, City, OWNER or ENGINEER for the cost of such repairs.

The CONTRACTOR shall, at all times, keep a sufficient width of the roadway clear of dirt and other materials to allow the free flow of traffic on the project site. The CONTRACTOR shall assume any and all responsibility for damage, personal or otherwise, that may be caused by the construction along roads or private drives.

I.48. PRELIMINARY FIELD TESTS

As soon as conditions permit, the CONTRACTOR shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests disclose any equipment furnished under this contract which does not comply with the requirements of the contract documents, the CONTRACTOR shall, prior to the acceptance tests, make all changes, adjustments, and replacements required.

Equipment which is subject to a "start-up" will be paid at ninety-five percent (95%) of the schedule of values amount, less retainage, when construction of the equipment is complete. The remaining five percent (5%) will be paid when the equipment is placed in service. Retainage will be released as per the Final Payment terms.

I.49. FINAL FIELD TESTS

Upon completion of the work and prior to final payment, all items installed under this contract shall be subjected to acceptance tests as specified or required to comply with the contract documents.

The CONTRACTOR shall furnish labor, fuel, energy, water, and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the OWNER.

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I.50. FENCES, IMPROVEMENTS, AND DRAINAGE CHANNELS

Fences or other improvements removed to permit construction shall be replaced in the same location and left in a condition as good as, or better, than that in which they were found. There shall be no separate pay item for fences removed or damaged beyond the limits shown in the plans.

Temporary fencing for maintenance of site security shall be provided by the CONTRACTOR at his expense. Temporary fencing, with gates, to restrain livestock shall be provided through areas where livestock are pastured, unless the CONTRACTOR makes satisfactory arrangements with the land owner and/or tenant. The temporary fence shall be installed on the easement lines and shall be removed after the trench has been backfilled.

Where surface drainage channels or drainage structures are disturbed or altered during construction, they shall be restored to their original condition of grade and cross section as soon as possible.

Temporary channels required to provide adequate drainage during construction shall be provided and maintained by the CONTRACTOR. No separate payment shall be allowed.

I.51. DUST CONTROL

CONTRACTOR shall take responsible measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. Dusty materials in piles or in transit shall be covered when practical to prevent blowing. Dust control shall be provided on all days within the contract period regardless of work taking place or not. CONTRACTOR shall allow at least four times per day as required. No separate pay shall be provided.

Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels or similar equipment, shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

I.52. ENVIRONMENTAL PROTECTION REQUIREMENTS

The CONTRACTOR shall provide and maintain, during the life of the contract, environmental protection as defined herein:

1. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice.

2. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project.

3. Comply with Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances,

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and noise pollution. Obtain all construction and disposal permits as required.

I.53. ENVIRONMENTAL PROTECTION PLAN

All of the CONTRACTOR's employees shall be trained on the site Environmental Protection Plan requirements. The CONTRACTOR shall meet all requirements of the OWNER's Environmental Protection Plan described herein.

1. Land Resources: Except in areas to be cleared, DO NOT remove, cut, deface, injure, or destroy trees or shrubs without the OWNER's permission. DO NOT fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the OWNER. Where such use of attached ropes, cables, or guys is authorized, the CONTRACTOR shall be responsible for any resultant damage.

2. Replacement: Trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain OWNER approval before replacement.

3. Oily and Hazardous Substances: Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR §112, surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus ten percent (10%) freeboard for precipitation. The berm shall be impervious to oil for seventy-two (72) hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

4. Storm Water Drainage: There shall be no discharge of excavation groundwater to the sanitary sewer, storm drains, or to drainage ditches without prior specific authorization by required regulatory agencies and OWNER in writing. Discharge of hazardous substances will not be permitted under any circumstances. Construction site runoff shall be prevented from entering any storm drain or the drainage ditch directly by the use of straw bales or other method suitable to the ENGINEER. CONTRACTOR shall provide erosion protection of the surrounding soils. CONTRACTOR shall be responsible for payment and receipt of a stormwater permit if necessary. CONTRACTOR shall maintain stormwater controls of said permit per state, local agencies or ENGINEER and OWNER.

5. Fish and Wildlife Resources: DO NOT disturb fish and wildlife. DO NOT alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

6. Burn-off: Burn-off of the ground cover is not permitted.

7. Protection of Erodible Soils: Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to

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minimize the duration of exposure of unprotected soils.

8. Temporary Protection of Erodible Soils: Use the following methods to prevent erosion and control sedimentation:

   a. Mechanical Retardation and Control of Runoff: Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and straw bales to retard and divert runoff to protected drainage courses.
   b. Vegetation and Mulch: Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydro-seeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.
   c. Provide new seeding where ground is disturbed. Include topsoil or nutrients during the seeding operation necessary to establish a suitable stand of grass.

9. Control And Disposal Of Solid Wastes: Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Remove all solid waste (including non-hazardous debris) from the property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including 40 CFR §241, 40 CFR §243, and 40 CFR §258.

10. Dust Control: Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will not be permitted.

11. Noise: Make the maximum use of low-noise emission products, as certified by the EPA. Confine soil placement operations to the period between 7 A.M. and 5 P.M., Monday through Friday, exclusive of holidays, unless otherwise specified.

12. Spill Control: In the event of a spill or release of a hazardous substance (as designated in 40 CFR §302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the CONTRACTOR shall notify the OWNER immediately. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, state, and local regulations. As directed by the OWNER, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the OWNER.

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13. Spill Response Materials:

a. The CONTRACTOR shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

b. Within five days after the award of contract, the CONTRACTOR shall meet with the OWNER to discuss the project and verify a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken.

c. The ENGINEER must receive from the CONTRACTOR a letter signed by an officer of the firm appointing a project Environmental Manager and stating that he/she is responsible for managing and implementing the Environmental Program as described in this contract. The Environmental Manager must have authority to direct the removal and replacement of non-conforming work, and the letter shall include a statement of this authority.

I.53. ISRAEL LAW

A government entity may not enter into a contract with a Company for goods or services unless the contract contains a written verification from the Company that it:

1. Does not boycott Israel; and

2. Will not boycott Israel during the term of the contract.

I.54. SYSTEM FOR AWARD MANAGEMENT

All contractors/subcontractors must have an active registration with the System for Award Management (www.SAM.gov) and have been cleared. An evidence of active registration must be submitted with bid.

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SECTION B

SPECIAL INSTRUCTIONS

B.1. TRAFFIC CONTROL

The CONTRACTOR will be responsible for furnishing and using all barricades, warning lights, signs, etc. necessary to protect his work and maintain traffic flow satisfactory **to the OWNER, ENGINEER, and TxDOT** (if applicable). Warning devices shall be as required in the Texas Manual on Uniform Traffic Control Devices. Construction shall be scheduled to cause the least amount of disruption to traffic. All work scheduling shall be coordinated with the City or County staff, and be approved by the City or County staff before work can proceed. **No separate payment** will be made for traffic control required to be added to the project to address health and safety issues.

Traffic Control plans and details provided (if applicable) in the plans are to show a minimum expectation required by the CONTRACTOR and may not cover all specific construction means and methods proposed by the CONTRACTOR. Alternate plans may be presented for approval by the OWNER and ENGINEER by the CONTRACTOR. All plans shall be sealed by a professional engineer registered in the State of Texas. The OWNER or ENGINEER may require additional warning devices be installed at any time on the project to address health and safety issues at no additional cost to the OWNER.

B.2. STAKING FOR CONSTRUCTION

The CONTRACTOR will provide all construction staking services for the project. The cost of these services will be reflected in the unit price amount bid in the proposal. **No separate payment will be made.**

TRC Engineers, Inc. provided topographical surveying services for the design portion of this project. Information to the CONTRACTOR for construction staking may be available from TRC Engineers, Inc.

B.3. OFFICE AT SITE OF WORK

1. During the performance of this contract, CONTRACTOR shall maintain a suitable office at the project site. The office shall be the headquarters of his representative authorized to receive drawings, instructions, or other communication or articles. Any communication given to the said representative or delivered at CONTRACTOR's office at the site of the work in his absence shall be deemed to have been delivered to CONTRACTOR.
2. Copies of the Drawings, Specifications, and other Contract Documents shall be kept at CONTRACTOR's office at the site of the work and available for use at all times.

3. CONTRACTOR shall provide all power for heating, lighting, operation of CONTRACTOR's plant or equipment, or for any other use by CONTRACTOR. Temporary heat, lighting and air conditioning shall be maintained until the work is accepted. CONTRACTOR shall work with the OWNER to establish temporary power to the site, however all costs required shall be borne by the CONTRACTOR.

4. CONTRACTOR shall be responsible for protection of the site, and all work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.

5. No claim shall be made against ENGINEER or OWNER by reason of any act of an employee or trespasser.

6. CONTRACTOR shall provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Project, as required, to avoid any need for parking personal vehicles where they may interfere with public traffic, OWNER's operations, or construction activities.

7. CONTRACTOR shall provide suitable working space for ENGINEER or Owner's representative within office. Room shall be at least 200 square feet of the floor space, either adjacent to or partitioned off from CONTRACTOR'S office. The office shall be provided with an outside entrance door with a substantial lock; glazed windows suitable for light and ventilation; and adequate heating, air conditioning, electrical, and lighting facilities. The office shall be equipped with a suitable desk, two chairs, plan rack, four-drawer file cabinet, a work table, and a garbage can. The general arrangement of the office and facilities provided shall be acceptable to the ENGINEER and OWNER.

B.4. WATER

Water required for water jetting, flooding, testing and construction will be provided by OWNER at no cost to the CONTRACTOR. The CONTRACTOR shall provide temporary water piping, valves, transportation, etc. to the project location as required.

B.5. POWER FOR CONSTRUCTION

The electrical service to the site will be provided by the CONTRACTOR. The CONTRACTOR shall furnish and install all necessary temporary wiring, and furnish and install area distribution boxes so located that the individual trades may use their own construction type extension cords to obtain adequate power and artificial lighting at all points where required by inspectors and for safety. All necessary permits shall be acquired by the CONTRACTOR.

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B.6. CONSTRUCTION ORDER

The CONTRACTOR shall complete the various projects in order of priority (Item 1. being highest priority), as follows:

1. Ground Storage Tank
2. Metal Building
3. 12" Inlet Water Line
4. Fencing

Each consecutive priority item shall be completed as soon as possible. This is not to preclude work on lesser priority items if there are long lead delivery requirements on materials for the higher priority items. However, as materials become available, the higher priority item shall be completed first.

B.7. SUBMITTAL DATA

Submittal Procedure:

1. The CONTRACTOR shall furnish Submittals for any and all such parts of the work and equipment as set forth in the specifications and indicated on the plans. The procedures for review of the submittals shall be as follows:

   a. The CONTRACTOR shall submit to the ENGINEER for his review, four (4) prints of drawings, plus whatever number of prints the CONTRACTOR desires to be returned to himself. The submitted prints shall be accompanied by a letter of transmittal, in duplicate of drawings, titles, and other requirements. The letter of transmittal shall be of the form supplied by or approved by the ENGINEER. If advance approval is obtained by OWNER and ENGINEER, electronic submission of certain submittals may be acceptable.

   b. When a drawing is satisfactory to the ENGINEER, the number of prints the CONTRACTOR desires returned to him will be stamped or marked, "No Exceptions Taken" or "Make Corrections Noted", will be dated, and will be returned to the CONTRACTOR by letter.

   c. Should a drawing be unsatisfactory to the Engineer, he will stamp thereon "Revise and Resubmit", or "Rejected", and will return one (1) or more copies thereof to the CONTRACTOR with the necessary corrections and changes indicated. The CONTRACTOR must make such corrections and changes, and again submit at least four (4) prints of the drawings for approval. The CONTRACTOR shall revise and resubmit the working drawings, as required by the ENGINEER, until satisfactory review thereof is obtained.

   d. The CONTRACTOR shall allow sufficient time for preliminary review, correction, and resubmission, and final review of all working (shop) drawings. The CONTRACTOR should allow not less than fourteen (14) days for each review. Drawings of items critical to job progress, when requested in writing by the CONTRACTOR, will be given priority review.

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Submittal Format:

1. Submittals shall be printed on heavy, first quality paper, 8-1/2" x 11" size with standard 3-hole punching. If pre-approved, electronic submittals may be acceptable. Drawings and diagrams shall be reduced to 8-1/2" x 11" or 11" x 17".

2. All materials and equipment submitted for review shall meet the following criteria: Each sheet of descriptive literature submitted shall be marked by the CONTRACTOR to identify the material or equipment as follows:

    a. Equipment and materials descriptive literature and drawings shall show the specification paragraph for which the equipment applies, and shall list equipment tag numbers applicable.
    b. Submittal sheets or drawings showing more than the particular item under consideration shall have crossed out all but the pertinent description of the item for which review is requested.
    c. Equipment and materials descriptive literature not readily cross-referenced with the drawings or specifications shall be identified by a suitable notation.

Submittal Content:

1. The submittals shall show that all requirements of the specification section have been met. The submittals shall contain the following information as applicable:

    a. Equipment, function, normal operating characteristics, and limiting conditions.
    b. Assembly, installation, alignment, adjustment, and checking instructions.
    c. Outline, cross-section, and assembly drawings; engineering data; and wiring diagrams.
    d. Test data and performance curves, where applicable.
    e. The operational and maintenance manual for the equipment item and/or system as designated in Table 1 below, or as required elsewhere within these specifications shall be submitted.

TABLE 1. SUBMITTAL AND O & M SUMMARY

Item Description	Submittal Required	O&M Manual Required	Working Drawing Required	O&M Instructions Required
Welded Steel Tank	X		X	
Metal Building	X		X	
Structural Concrete	X			
Reinforcing Steel	X			
Backfill Material	X			
Valves	X			

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Item Description	Submittal Required	O&M Manual Required	Working Drawing Required	O&M Instructions Required
Tank Appurtenances	X			
Fencing	X			
Protective Coatings	X			
Pipe	X			
Fittings	X			
Tapping Sleeves	X			
Tracer Wire	X			
Miscellaneous – Water Line Items	X			

f. Working Drawings:

i. Items for which working drawings are required include, but are not limited to, the non-equipment items listed in Table 1, and as set forth elsewhere within these specifications.

ii. The drawings shall be numbered consecutively and shall accurately and distinctly present the following:

a) All working and erection dimensions.
b) Arrangement and sectional views.
c) Necessary details, including complete information for making connections between functional parts.
d) Kinds of materials and finishes.
e) Parts list and description thereof.

iii. Each drawing shall be dated and shall bear the name of the project, names of equipment or materials, and the location where the equipment or materials are to be installed in the project. The Engineer may decline to consider any working drawings, which do not contain complete data on the work and full information on related matters.

iv. If working drawings show departures from the contract requirements, the CONTRACTOR shall make specific mention thereof in a letter attached to the submittal form; otherwise, review of such submittals will not constitute acceptance of the departure from the contract.

v. No Work called for by working drawings shall be initiated until the said drawings have been accepted by the ENGINEER.

B.8. MATERIALS FOR WATER MAIN CONSTRUCTION

Pipe for PVC water main construction, unless otherwise shown on the plans, shall be polyvinyl chloride pipe, meeting the requirements of AWWA C-900 or C-905 as applicable. Pipe shall be blue in color (other colors not acceptable). Pipe joints shall be rubber ring type gasket in an integrated thickened bell. All other fittings 12" and smaller shall be short body ductile iron.

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All pipe, fittings, and valves shall be new. All water pipe shall be approved by the Underwriters laboratories for fire protection, approved by the National Sanitation Foundation and installed according to manufacturer's specifications and Section W - WATER MAIN CONSTRUCTION of these specifications.

All fittings and valves for WATER MAIN CONSTRUCTION shall be mechanical joint or as specified on the plans.

B.9. WATER MAIN – RESTRAINED JOINTS

All fittings for the proposed water main projects shall include meg-a-lug restrained joints. This shall include valves and fire hydrants.

B.10. WATER LINE DISINFECTION

The CONTRACTOR's unit price bid costs shall include the services of a certified laboratory to perform the "Bac-T" tests for the newly installed water mains/services. The sample shall be acquired by a direct employee of the lab. Samples acquired by the CONTRACTOR will not be acceptable. Sampling and testing shall meet all requirements of TCEQ. The Owner's representative will be notified of when the sample will be acquired. The CONTRACTOR shall submit the name of the laboratory to the ENGINEER for approval. There will be no separate pay for these services.

B.11. BEDDING

The project may include the installation of gravel bedding for the construction of the water mains. The requirement for the bedding method shall be as follows:

1. Gravel Bedding - An approved gravel bedding material shall be brought up by hand backfilling equally on each side of the pipe and extend from a point six (6") inches below the pipe to a height of six (6") inches over the top of the pipe. The initial lift of the gravel bedding material shall be placed on the trench floor and then shaped and compacted mechanically to insure that the sewer pipe is evenly supported along its entire length.

2. Sand Bedding - An approved sand bedding material shall be brought up by hand backfilling equally on each side of the pipe and extend from a point six (6") inches below the pipe to a height of six (6") inches over the top of the pipe. The initial lift of the sand bedding material shall be placed on the trench floor and then shaped and compacted mechanically to insure that the sewer pipe is evenly supported along its entire length.

B.12. ABANDONMENT OF EXISTING WATER LINES

The project will parallel several existing eater lines. It will be the CONTRACTOR's responsibility to take these existing water lines out of service, whether or not the lines to be abandoned are indicated on the plans. The CONTRACTOR shall plug the existing lines to be

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abandoned with an approved fitting. This work shall be deemed incidental to the project. **No separate payment will be made.**

B.13. ADJUSTING EXISTING MANHOLES AND VALVE COVERS

The CONTRACTOR will adjust all existing manholes (to include telephone, electrical, sanitary sewer or other), valve covers (to include water, gas, or other) within the construction area to meet the grade of the finished elevation. The following procedure will be followed where the valve or manhole is in an area that is to be excavated and new base material installed or existing base material re-constructed:

1. Locate and accurately tie down by measurements from identifiable objects (such as power poles, fire hydrants, fences, etc.) all existing manholes and valve covers for future use.

2. Remove and lower existing manholes and valve boxes to an elevation below the finished subgrade. The depths on manholes shall be sufficient that on reconstruction, the manhole shall be low enough to provide an adequate cone section and manhole ring and cover.

3. A steel plate of sufficient size shall be placed over the open manhole and/or box riser at subgrade elevation.

4. Placement and compaction of all crushed stone base material shall be made within the construction area to achieve compaction over the entire street.

5. The CONTRACTOR shall then relocate all manholes and valve steel covers from tie downs in #1 and remove steel covers.

6. Manholes and valve box covers shall be reconstructed to finished asphalt grade. Backfill around the reconstructed covers shall be concrete to top of base material grade.

7. Final placement and compaction of the Hot Mix (unless otherwise shown on the plans) shall follow. Extreme care shall be taken in the lowering of manholes to avoid any dirt, gravel, concrete or other foreign material from falling into manhole. Should this occur, the CONTRACTOR shall remove the foreign material immediately in order to avoid stopping the flow of sewage.

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SECTION CW

CARE OF WATER

CW.1 SCOPE

The work covered by this section of the specifications consists of furnishing all labor, equipment, and materials, and of performing all operations in connection with the care of water during construction, complete, in strict accordance with this section of the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

CW.2 CONDUCT OF WORK

All permanent work shall be constructed in areas continuously maintained free of water. The Contractor shall construct and maintain such dikes, plugs, diversion and drainage channels, and/or other protective work as necessary as to continuously protect the area. The Contractor shall also furnish, install, maintain, and operate all necessary pumping and other equipment for continually dewatering the work area. All temporary protective works and dewatering equipment shall be removed by the Contractor after serving their purposes.

All work shall be staged and conducted in such a manner that no constriction of flow capacity in the channel occurs. At all times, conveyance in the channel should be maintained at least at the level of the existing channel prior to construction. The contractor shall submit a plan for review and approval, outlining in detail his proposed excavation/construction staging. The plan shall specifically address care of water.

Seepage waters may be encountered in portions of the work area. The Contractor shall design and construct temporary dewatering systems to such extent that the required construction can be accomplished.

The contractor shall not be allowed to dam the existing drainage ditch or alter the movement of water within the drainage ditch.

CW.3 PAYMENT

No separate payment will be made for work covered under this section of the specifications and all costs in connection therewith shall be included in the contract price for the work items to which the work pertains.

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SECTION C

CAST-IN-PLACE CONCRETE

C.1. DESCRIPTION

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification sections, apply to this Section.

This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

C.2. DEFINITIONS

Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

C.3. SUBMITTALS

Product Data: For each type of manufactured material and product indicated.

Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are Contractor's responsibility.

Welding Certificates: Copies of certificates for welding procedures and personnel.

Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Wall ties & wall tie hole sealing process.
4. Steel reinforcement and reinforcement accessories.

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5. Admixtures.
6. Waterstops.
7. Curing materials.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Epoxy joint filler.
13. Joint-filler strips.
14. Repair materials.

C.4. QUALITY ASSURANCE

Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

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Pre-installation Conference: Conduct conference at Project site.

1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixes.
    c. Ready-mix concrete producer.
    d. Concrete subcontractor.

C.5. DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.

C.6. FORM-FACING MATERIALS

Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

    a. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.

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

Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

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

Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

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1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

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

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.

2. Furnish ties that, when removed, will leave holes not larger than 1 inch diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

4. Through wall tapered ties are acceptable with the usage of "Greenstreak's P120 X-Plug".

C.7. STEEL REINFORCEMENT

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

Plain-Steel Wire: ASTM A 82, as drawn.

Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

C.8. REINFORCEMENT ACCESSORIES

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

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

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

C.9. CONCRETE MATERIALS

Portland Cement: ASTM C 150, Type I/II.

1. Fly Ash: ASTM C 618, Class C or F.

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Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Class: Severe weathering region, but not less than 3S.

2. Class: Moderate weathering region, but not less than 3M.

3. Class: Negligible weathering region, but not less than 1N.

4. Nominal Maximum Aggregate Size: 1-1/2 inches.

5. Nominal Maximum Aggregate Size: 1 inch.

6. Nominal Maximum Aggregate Size: 3/4 inch.

7. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.

Water: Potable and complying with ASTM C 94.

C.10. ADMIXTURES

General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

Air-Entraining Admixture: ASTM C 260.

Water-Reducing Admixture: ASTM C 494, Type A.

High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Catexol 1000CL; Axim Concrete Technologies.
   b. MCI 2000 or MCI 2005; Cortec Corporation.

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c. DCI or DCI-S; W. R. Grace & Co., Construction Products Div.
d. Rheocrete 222+; Master Builders, Inc.
e. FerroGard-901; Sika Corporation.

C.11. WATERSTOPS

Strip Waterstops: Manufactured rectangular or trapezoidal strip.

1. Products: Subject to compliance with requirements, provide the following:

a. Hydrotite CJ-0725-3K-ADH with Leakmaster.

C.12. VAPOR RETARDERS

Vapor Retarder: ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 10 mils thick:

1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils thick.

C.13. CURING MATERIALS

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

Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

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

Water: Potable.

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

Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

Products: Subject to compliance with requirements, provide one of the following:

1. Evaporation Retarder:

a. Cimfilm; Axim Concrete Technologies.
b. Finishing Aid Concentrate; Burke Group, LLC (The).
c. Spray-Film; ChemMasters.
d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
e. Sure Film; Dayton Superior Corporation.
f. Eucobar; Euclid Chemical Co.

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g. Vapor Aid; Kaufman Products, Inc.
h. Lambco Skin; Lambert Corporation.
i. E-Con; L&M Construction Chemicals, Inc.
j. Confilm; Master Builders, Inc.
k. Waterhold; Metalcrete Industries.
l. Rich Film; Richmond Screw Anchor Co.
m. SikaFilm; Sika Corporation.
n. Finishing Aid; Symons Corporation.
o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.

2. Clear, Waterborne, Membrane-Forming Curing Compound:

a. AH Clear Cure WB; Anti-Hydro International, Inc.
b. Klear Kote WB II Regular; Burke Chemicals.
c. Safe-Cure & Seal 20; ChemMasters.
d. High Seal; Conspec Marketing & Manufacturing Co., Inc.
e. Safe Cure and Seal; Dayton Superior Corporation.
f. Aqua Cure VOX; Euclid Chemical Co.
g. Cure & Seal 309 Emulsion; Kaufman Products Inc.
h. Glazecote Sealer-20; Lambert Corporation.
i. Dress & Seal WB; L&M Construction Chemicals, Inc.
j. Vocomp-20; W. R. Meadows, Inc.
k. Metcure; Metalcrete Industries.
l. Cure & Seal 150E; Nox-Crete Products Group, Kinsman Corporation.
m. Rich Seal 14 percent E; Richmond Screw Anchor Co.
n. Kure-N-Seal WB; Sonneborn, Div. of ChemRex, Inc.
o. Florseal W.B.; Sternson Group.
p. Cure & Seal 14 percent E; Symons Corporation.
q. Seal Cure WB 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
r. Hydro Seal; Unitex.
s. Starseal 309; Vexcon Chemicals, Inc.

C.14. RELATED MATERIALS

Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

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

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

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1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.

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

3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

C.15. REPAIR MATERIALS

Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

C.16. CONCRETE MIXES

Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

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Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

Footings, Piers, Foundation Walls, Slab-On-Grade & Containment Walls: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4000 psi.

2. Minimum Cementatious Materials Content 540 lb/cu. Yd.

3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches

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

1. Fly Ash: 20 percent.

Maximum Water-Cementitious Materials Ratio: 0.45 for all concrete.

Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.

Do not air entrain concrete for trowel-finished interior floors and suspended slabs.

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

Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for all waste water treatment plan structures, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

C.17. FABRICATING REINFORCEMENT

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

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C.18. CONCRETE MIXING

Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

C.19. FORMWORK

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

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

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

1. Class A, 1/8 inch.

Construct forms tight enough to prevent loss of concrete mortar.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

Do not use rust-stained steel form-facing material.

Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

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

Chamfer exterior corners and edges of permanently exposed concrete.

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

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

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

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

C.20. EMBEDDED ITEMS

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

1. Install anchor bolts, accurately located, to elevations required.

C.21. REMOVING AND REUSING FORMS

General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 72 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. 28-day design compressive strength.

2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.

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

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

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

C.22. VAPOR RETARDERS

Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

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C.23. STEEL REINFORCEMENT

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

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

Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

Set wire ties with ends directed into concrete, not toward exposed concrete surfaces. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

C.24. JOINTS

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

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

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Submit proposed location of construction joints to Engineer for approval prior to beginning of work.

3. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

4. Space vertical joints in walls as indicated.

5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

Contraction Joints in Slabs-on-Grade: Use only where shown in the Construction Documents. Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

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1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C.25. WATERSTOPS

Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable

C.26. CONCRETE PLACEMENT

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

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

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

Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit

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duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

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

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

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2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

C.27. FINISHING FORMED SURFACES

Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8" in height.

1. Apply to concrete surfaces not exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

Rubbed Finish: Apply the following to smooth-formed finished concrete that will be exposed to public view:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

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

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

C.28. FINISHING FLOORS AND SLABS

General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

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1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot- long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:

    a. 1/8 inch.

Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with ENGINEER before application.

C.29. MISCELLANEOUS CONCRETE ITEMS

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

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Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

C.30. CONCRETE PROTECTION AND CURING

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing. Moisture cure all fluid containing structures a minimum of 120 hours after placement

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

Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

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

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

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

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a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

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

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

C.31. CONCRETE SURFACE REPAIRS

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

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

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

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

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3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by ENGINEER.

Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

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

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

C.32. FIELD QUALITY CONTROL

Testing Agency: CONTRACTOR will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article. Testing agency shall be approved by ENGINEER

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

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

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of five standard cylinder specimens for each composite sample.

    a. Cast and field cure one set of five standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days , two at 28 days and one at 56 days if required.

    a. Test two field-cured specimens at 7 days and two at 28 days.

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b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi. Test results shall be reported in writing to ENGINEER, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by ENGINEER but will not be used as sole basis for approval or rejection of concrete.

Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by ENGINEER. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by ENGINEER.

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SECTION EX

EXCAVATION, FILLING AND BACKFILLING

EX.1. SCOPE

Excavation shall include the removal of any trees, stumps, brush, debris, or other obstacles that may obstruct the construction of the work; and the excavation and removal of all earth, rock, or other materials to the extent necessary to construct all the work shown on the plans to the lines and grades as indicated thereon. Excavation shall be of ample width to permit proper construction and removal of forms. As may be required by the Engineer, excavations shall be back sloped so as to be safe and so that the ground alongside the excavation will not slide or settle.

The locations of excavation, and the limits thereof, and waste disposal areas are generally as shown on the drawings. All excavation shall be staged as required in SECTION CW - CARE OF WATER.

All excavation under this contract will be unclassified and will not be measured or paid for as a separate bid item. The cost of excavation shall be included in the appropriate bid item of the Proposal.

If a geotechnical report was prepared for this project and is referenced in the drawings for particular structures, piping, etc., the report shall take precedence over any other requirements listed in the plans and specifications.

EX.2. SHAPING AND TRIMMING

Excavations shall be of such dimensions as to permit the proper construction of the work in the manner, shape, and size shown on the plans. Wherever the nature of the soil is such as to permit the making of a proper subgrade, the bottom of the excavation shall have the shape and dimensions shown on the plans. In such case machine excavation shall be so controlled as to not cut below grade and final trim shall be by hand labor. The subgrade so made shall be free from all loose material before concrete is placed.

EX.3. SUBGRADE AND ADDITIONAL EXCAVATION

It is the intent of these specifications that the subgrade for all structures be excavated or prepared so as to provide a firm and unyielding foundation, brought to true line and grade, upon which the work may be constructed.

In case the materials encountered at subgrade elevation are not stable or are otherwise deemed unsatisfactory by the Engineer, the excavation shall be carried to such additional depth as the Engineer may direct. The Contractor shall refill such excavated space to subgrade level with gravel, or otherwise as the Engineer may direct.

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EX.4. FILLING

Where concrete floor slabs are placed on earth, all loam and organic or other undesirable material as determined by the Engineer, shall be removed. Where broken stone, sand, or gravel is used for fill, it shall be placed in layers not exceeding eight inches (8") in thickness and thoroughly compacted with hand or machine tampers or other approved methods. Where earth is used for fill, it shall be placed in layers not exceeding six inches (6") in depth. Each layer shall be uniformly spread, moistened as required, and then compacted. Compaction shall be done by a power roller or other manner approved by the Engineer. The subgrade shall be brought to a reasonable true and even plane.

EX.5. MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for this item.

EX.6. UNAUTHORIZED EXCAVATION

Wherever, through neglect of the Contractor, the excavation is carried beyond or below the lines and grades as given by the Engineer or as shown on the plans, except as specified above, all such excavated space shall be refilled with such material and in such a manner, as may be directed by the Engineer, so as to insure the stability of the affected structure. Beneath all structures, space excavated without authority shall be refilled by the Contractor, at his own expense, with 2,000 psi concrete and as directed by the Engineer.

EX.7. CONDUCT OF WORK

1. Drainage: Drainage of all required excavation areas shall be maintained at all times to prevent ponding, sloughing, subsequent soft ground conditions and saturation of materials to be excavated. The contractor shall submit a plan as required in SECTION CW - CARE OF WATER.

2. Protection of Structures: The Contractor shall protect any existing structures along the work area, and any damage to the existing structures due to his operations shall be repaired immediately at the expense of the Contractor, and to the satisfaction of the Engineer.

3. Protection of Existing Utility Lines: Utility lines that are shown on the drawings or the locations of which are made known to the Contractor shall be protected from damage, and if damaged, shall be repaired by the Contractor at his expense. In the event that the Contractor damages any utility lines that are not shown on the drawings or the locations of which are not known to the Contractor it is the Contractor's responsibility to repair the damage at his own expense and restore the structure to its functional use.

4. Haul Roads: On-site haul roads shall be located and constructed as approved by the Engineer. These shall be designed to safely carry the intended traffic, to be free draining, shall be maintained dust free and in

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good condition throughout the contract period and shall be removed as directed by the Engineer. No separate payment will be made for any layout, materials, construction, maintenance and removal of haul roads, or any portion of the work or other costs associated with these haul roads and all such costs shall be considered a subsidiary obligation of the Contractor.

The Contractor shall cooperate with the City and/or County in the establishment of truck haulage routes, maximum load restrictions, and all environmental regulations.

5. Lines and Grades: All excavation shall be to the lines and grades shown on the drawings or established by the Engineer. Grade tolerance for excavation shall be zero to minus two (2") inches. Any and all excess and/or over-excavation, unless specifically ordered in writing by the Engineer, shall be at the expense of the Contractor. The Engineer may require filling of any excess or over-excavation with suitable materials at the expense of the contractor. Suitable materials for backfilling areas of over-excavation include compacted fill, filter materials, bedding, or concrete, depending on location, as determined by the Engineer. Fill or filler materials shall be placed and compacted as specified by the Engineer. Foundations for structures shall be inspected and approved by the Engineer prior to placement of reinforcing steel.

EX.8. REMOVAL AND DISPOSAL OF MATERIAL

Surplus excavated material, in excess of that required for backfilling and site grading as required by the plans, shall be disposed of offsite in accordance with applicable TCEQ regulations or at a site obtained by the Contractor and approved by the Engineer.

1. Method of Excavation: Excavation of material may be performed using any type of excavating or hauling equipment adaptable to the conditions encountered and by any approved method elected by the contractor.

2. Wasting of Excavation Materials: Excavated materials that are not acceptable for fill (concrete, asphalt, wire, etc.) shall be disposed of in approved waste disposal areas in an approved manner.

3. The cost of hauling materials to disposal areas and all costs of placing and spreading the waste materials (at the disposal areas) and dressing of the surfaces thereof shall be included in the contract unit price.

EX.9. REMOVAL OF WATER

The Contractor shall, during the excavation period and as long thereafter as the condition of the work may require, provide and maintain, in good operating condition, pumping equipment full adequate in capacity to promptly remove all water entering any excavation or other parts of the work.

All excavations shall be kept dry and water pumped or drained from the work shall be disposed of in such a manner as to prevent damage to adjacent property or to other work under construction. Any and all damage, of whatever nature, caused by dewatering the work shall be promptly repaired or remedied by the Contractor at his own expense. This shall include the cleaning and flushing of existing drainage pipe lines where such are used.

EX.10. BACKFILLING

Excavations for structures shall be backfilled to original ground level, or to such other grades as the Engineer may direct. The time elapsing before backfilling is begun shall be subject to the Engineer's approval. All backfilling shall be carried along in an orderly manner and as expeditiously as is consistent with good scheduling.

Before backfill around structures, all lumber, rubbish, braces, and refuse shall be removed from the excavation and disposed of in a manner satisfactory to the Engineer.

Material used for backfill shall, unless otherwise specified, be good sound earth, free from waste, rubbish, objectionable organic matter, large rocks, waste concrete, or other unstable or unsuitable material.

It is essential that the backfill around structures be so placed, compacted, and built up as to minimize future settlement as much as is reasonably possible. To this end, care shall be exercised in selecting backfill material free from large hard clay lumps, especially in cramped areas directly adjoining the walls of structures.

The backfill around structures shall be brought up in horizontal layers of uniform thickness. Each such layer shall not be more than eight inches (8") in depth when measured loose. As may be necessary to attain maximum compaction, the backfill material shall be moistened by sprinkling lightly with water. After placing, each layer of backfill shall be thoroughly and uniformly compacted means of mechanical tampers or small impact type rollers. The compacting equipment and the manner of its use shall be subject to the approval of the Engineer.

The fill under structures and backfill adjacent to structures shall be compacted in lifts as specified to a minimum density of 95% as determined in accordance with ASTM specification D 1557.

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SECTION ETS

TRENCH EXCAVATION SAFETY PROTECTION

ETS.1. DESCRIPTION

Furnish and place excavation protection for trenches deeper than five (5') feet.

ETS.2. CONSTRUCTION

Trench protection for all trenches over five (5') feet in depth shall be accomplished by the Contractor in accordance with all provisions of PART 1926, SUBPART P - EXCAVATIONS, TRENCHING, AND SHORING AND INTERPRETATIONS (OSHA), or any updated and subsequent version thereof.

It is the sole duty, responsibility, and prerogative of the Contractor, not the Owner or Engineer, to determine the specific applicability of a trench safety system to each field condition encountered on the project. It will be the Contractor's responsibility to identify the soil type and to accurately adjust his trench safety methods according to the OSHA requirements.

The Contractor shall indemnify and hold harmless the Owner, its employees and agents, from any and all damages, costs, (including, without limitation, legal fees, court costs, and the cost of investigation), judgments or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.

The Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner in case the Owner is negligent either by act or omission in providing for trench safety, including, but not limited to, inspections, failure to issue stop work orders, and the hiring of the Contract.

ETS.3. PAYMENT

THE BID ITEM FOR "OSHA TRENCH SAFETY" SHALL INCLUDE PAYMENT FOR THE ACTUAL TRENCH WALL SUPPORT, ENGINEERING, PERMITS, ETC. DAMAGES TO ADJACENT EXISTING UTILITIES AND IMPROVEMENTS OF ANY KIND THAT OCCUR WHEN THE TRENCH WALLS MOVE, SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.

Payment will be made at the unit bid price per linear foot in the Proposal.

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SECTION DIP

DUCTILE IRON PIPE AND FITTINGS

DIP.1. GENERAL

The work to be performed under this section of the specifications shall comprise the furnishing of all labor, equipment, and materials, and in performing all operations necessary in connection with the installation of ductile iron pipe and fittings as shown in the plans, and as specified herein.

The Contractor shall submit for approval, complete and dimensional working drawings of all ductile iron pipe line layouts. Such drawings shall indicate the size, class, and laying dimensions of all pipe, valve fittings, expansion couplings, and specials and the location of all hangers and supports needed for the installation and not specifically indicated for on the plans. The number, size, and length of all bolts required for flanged pipe installations shall be given on the pipe schedule of the working drawings.

All buried ductile iron pipe shall be Mechanical Joint with megalug glands.

DIP.2. DUCTILE IRON PIPE AND FITTINGS

Ductile Iron Pipe of size, class, and joint type shown on the plans will be furnished by the Contractor. All pipe furnished shall meet USA Standard A21.50, ANSI A 21.50, AWWA C150 (thickness design), or current revision. All Ductile Iron Pipe furnished shall also meet the requirements of federal specification ANSI A 21.51, AWWA C151, or current revision, minimum thickness Class 250, unless otherwise noted on the plans. Flanged Ductile Iron Pipe shall be furnished with Ductile Iron Flanges and shall conform to ANSI A21.15 and AWWA C115, minimum thickness Class 250.

Fittings shall be ductile iron and shall meet the requirements of ANSI A21.10/ AWWA C110 or ANSI A21.53/AWWA C153, or current revision, and ANSI A21.11/AWWA C111. All fittings for underground service shall be Mechanical Joint, unless shown otherwise on the plans. All fittings for above ground service shall be short body flanged fittings with Class 125 flanges. All flanges shall be faced and drilled. Compact fittings will be allowed as an alternate system.

Bell and spigot fittings or specials shall conform to AWWA Standards with bell dimensions suitable for use with the outside diameter of the spigots for which they must provide a socket. Where special fittings are required, they shall be approved design and have the same diameters and metal thickness as standard fittings, unless otherwise required, but their laying lengths and other functional dimensions shall be determined by their positions in the pipe lines and the requirements of the plans.

At the Contractor's option, ductile iron pipe, which will be underground, may be of push-on, rubber gasket type joint, or mechanical joint, minimum thickness Class 51, unless otherwise shown on the plans.

All joints shall be made in strict accordance with the manufacturer's specifications.

DIP.3. LININGS AND COATINGS

Ductile Iron Pipe and Fittings shall be cement mortar lined conforming to ANSI/AWWA B C104/A21.4 specifications for cement lining. Pipe and Fittings Exterior shall be uncoated as delivered to the job site, for encasement or painting as appropriate.

DIP.4. POLYETHYLENE ENCASEMENT

All ductile iron or cast iron pipe, fittings, and valves will be protected with polyethylene encasement in accordance with the latest revision of AWWA C 105 specification and/or ANSI A 21.5.

In general, the following items will summarize that specification, however, the Contractor will follow the entire specification as if written herein:

A. The pipe encasement material will be a polyethylene film with a thickness of 8 mils. Either tube or sheet material may be used with the following widths for the various pipe sizes:

Minimum Polyethylene Width		
Dia. of Pipe	**Flat Tube**	**Sheet**
6"	20"	40"
8"	24"	48"
12"	30"	60"
16"	34"	68"

B. The tube will completely encase each section of pipe with at least a one-foot (1') overlap at each joint. Overlaps will be secured by the used of adhesive tape, plastic string, or any other material capable of holding the encasement in place until backfilling operations are completed. The encasement shall prevent contact between the pipe and the surrounding bedding and backfill material, but is not intended to be a complete air and watertight enclosure.

C. Bell holes must be made at the joints to facilitate installation at the joints. Loose material will be overlapped to make a snug fit and secured with tape or string. Slack material along the barrel of the pipe shall be taken up to make a snug, but not tight, fit and secured at the quarter points of the pipe length.

D. Repairs to any rip, puncture, or other damage to the polyethylene will be made with adhesive tape or with short lengths of tubing cut, wrapped and secured in place prior to backfilling procedure.

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E. Backfill of the pipe shall be performed as described in Section S herein. The material of backfilling shall be free from cinders, refuse, boulders, rocks, stones, or other material that could damage the polyethylene.

DIP.5. EXPANSION COUPLINGS

Where the use of expansion couplings is indicated on the plans, they shall be Style 38 Dresser couplings, or approved equal, unless otherwise required.

As may be necessary to conform to the dimensions of the couplings, the outside diameter of the plain ends of the ductile iron pipe sections which are to be jointed by a coupling shall be gauged to proper size for use with the couplings.

DIP.6. HANDLING

During loading, transportation, and unloading, care shall be taken to prevent injury to the pipe or fittings. Loading or unloading shall be so handled that the piece being moved is under perfect control at all times. Under no circumstances shall a pipe or large fitting be dropped.

DIP.7. LAYING AND INSTALLING

Proper and suitable tools and equipment for the installation of the pipe lines and appurtenant valves and fittings in a safe and workmanlike manner shall be furnished and used on the work.

The pipe and fittings shall be thoroughly cleaned immediately before installation and shall be kept clean until final inspection of the project. Special care shall be exercised to prevent the leaving of wood, blocks, cans, tools, or other foreign objects in the pipe line during installation.

All costs incidental to the removal of any such foreign object, or objects, from the pipe line shall be borne by the Contractor.

All pipe lines shall be kept clean during construction. Small lines laid in excavated trenches shall have open ends or other openings, plugged with temporary bulkheads or caps at any time the work will be left in an uncompleted state for a period of more than eight (8) hours.

Pipe installed in excavated trenches shall be laid on a good foundation and supported throughout the length of the barrel on firm earth or sand fill. Trench excavation shall provide ample room at pipe joints to allow the joints to be made in a proper manner. All pipe lines shall be installed to grade and line as required by the plans.

Elbows, tees, etc., shall be properly blocked and anchored so that there will be no movement of the pipe due to internal and external pressure.

DIP.8. SUPPORTS AND HANGERS

The Contractor shall furnish and install all necessary supports and hangers,

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indicated on the plans or required for the proper installation of the ductile iron pipe lines in a workmanlike manner.

DIP.9. FLANGED JOINTS

Flanged joints shall be made with bolts, or bolt-studs, with a nut on each end. Bolts, stud-bolts, and nuts shall conform to American Standard Heavy dimensions; semi-finished, with square or hexagonal heads and cold punched hexagonal nuts meeting the requirements of ASA B18.2. Bolt sizes shall be American Standard for the flanges specified. Bolt and nut threads shall conform to ASA B1.1, coarse thread series, Class 2 fit.

Gaskets for Class 125 flanges shall be full face with bolt holes punches. Gasket material shall be nylon-reinforced rubber, 1/8" minimum thickness.

DIP.10. GASKET MATERIALS

Gaskets furnished for Flanged, Mechanical Joint, of Bell and Spigot Piping for Water, Wastewater, and process Air Service shall be of the materials specified below:

Temperature Minimum				
Service	**Joint Type**	**Rating**	**Thickness**	**Material**
Water	Flanged	150°F	1/8"	Nylon Reinforced Rubber
Water	M.J. or B&S	150°F		Styrene- Butadiene

DIP.11. WALL CASTINGS

Mechanical Joint Wall Sleeves will be utilized when possible. They shall be made of Ductile Iron, as specified, and they shall allow the pipe to pass completely through the sleeve to allow for flexibility and field adjustment. M.J. Wall Sleeves shall be one (1) static casing as manufactured by American Cast Iron Pipe Company or equal. Fabricated Wall Castings shall have Ductile Iron wall collars and shall be welded on both sides. Screwed-on bells will not be acceptable.

DIP.12. TESTING

As the Engineer may determine that pipe lines can be pressure tested for leakage without unreasonably expensive temporary bulkheads or blind flanges, such as might be required to test large diameter pressure lines, they shall be subjected to water test pressure of 150 psi. All such tests shall be conducted to the satisfaction and under the observation of the Engineer.

All costs incidental to making such tests shall be borne by the Contractor. Where pipe lines are laid in excavation, testing shall precede final backfill.

All pipe lines shall be watertight under test, or under operating conditions, as a condition of final acceptance of the work.

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DIP.13. BELL SPIGOT DUCTILE IRON PIPE

At the Contractor's option, Ductile Iron pipe, which will be underground, may be of the rubber gasket type joint as manufactured by the following companies.

1. "Tyton" - by United States Pipe and Foundry Company and by;

2. "Fastite" - by American Ductile Iron Pipe Company;

3. Approved Equal.

All joints shall be made in strict accordance with the manufacturer's specifications.

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SECTION W

WATER MAIN CONSTRUCTION

W.1. SCOPE

These specifications for construction of water mains are intended to be so written that only first-class workmanship and finish of the best grade and quality will result. The fact that the following specifications may fail to be so complete as to cover all details will not relieve the Contractor of full responsibility for providing a complete project of high quality, first class finish and appearance and satisfactory for operation.

The Contractor shall furnish all materials, labor, and equipment for constructing the work included in these specifications and as detailed on the plans.

W.2. PROTECTION OF WORK

When construction is stopped temporarily and at the end of the day's work, tight fitting stoppers or bulkheads shall be securely placed in or across the ends of all pipes.

The Contractor will be held responsible for the care of all work until final completion and acceptance, and he will be required to make good, at his own expense, any damage or injury it may sustain for any cause. He shall assume all risks from floods and casualties of every description and make no charge for damages from such cause.

W.3.1. MATERIALS

The Contractor shall furnish and place materials meeting the requirements of these specifications, of the dimensions and types at the locations and elevations shown on the plans or established by the Engineer. All materials shall be approved by the Engineer before being installed and any of these materials placed before they are so approved shall be removed and replaced with approved materials.

W.3.2. STORAGE OF MATERIALS

Materials delivered to the site of the work prior to their use shall be stored so as to cause the least inconvenience to the public, and in a manner satisfactory to the Engineer.

Materials that will deteriorate such as cement and mortar shall be stored in weather-tight buildings.

W.3.3. DESIGN PRESSURES

Pipe and fittings for water lines shall be designed to withstand minimum internal working pressures of one hundred fifty (150) pounds per square inch unless otherwise noted on the plans or in the bid proposal.

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W.4.1 TRENCHING AND BACKFILL FOR WATER MAIN CONSTRUCTION

This item consists of excavating all necessary trenches for the water main and system construction and backfilling after the pipe has been properly laid, inspected, and tested.

This work shall include the furnishing of all labor, materials, tools, equipment, and machinery necessary for clearing and removing from the site of the work, wherever located, all obstructions, trees, stumps, brush, vegetation and debris, and all earth, rock, and other materials to be excavated; the removal of existing structures except where specifically paid for as separate contract pay items; the stripping or removal of top soil or sod to be piled separately from other excavated materials and later to be restored to its original place after backfilling is completed; the furnishing, placing, and maintaining of all sheeting, shoring and bracing necessary to protect the work and adjacent properties, all pumping, bailing, and draining necessary to keep the excavation free from seepage water, water from sewers, drains, ditches, creeks, and other sources; provision for the uninterrupted flow of sewers and surface waters during progress of the construction; the removal, after completion of the work, of all sheeting, shoring, and bracing not necessary to support the sides of the excavation; the satisfactory disposal of excess and unsuitable materials not required or which cannot be used for backfilling, tamping, compacting, and refilling after settlement of all excavated areas; the restoring of all streets, alleys, fences, rights-of-way, and other lands or structures, private or public, damaged or occupied by the Contractor in the performance of the contract, to as good a condition as they were prior to the beginning of the work.

W.4.2. CLASSIFICATION

Excavation in trenches for water line construction will be unclassified and will not be paid for separately but shall be included in the price bid per linear foot for the various sizes of pipe unless specific provision for separate payment is called for in the Special Provisions and on the Proposal Form.

W.4.3. CONSTRUCTION METHODS

Trenches shall be excavated by trenching machine, backhoe or dragline, except in locations where hand trenching is required. The banks of trenches shall be vertical, to a point one (1) foot above the top of the pipe.

Trenches will be excavated to the lines and grades laid out by the Engineer or as shown on the plans. No change in locations of the lines is contemplated, but should any changes be made in the lines not materially altering the amount of character of the trenching to be done, the Contractor shall proceed with the changed alignment at the unit bid price. In case any change involves greater construction difficulties than the original alignment, the Owner and the Engineer will agree with the Contractor for extra compensation therefore, prior to the construction of the changed line or lines.

The width of the trench shall be six (6) inches minimum and eight (8) inches maximum on each side of the pipe bell.

Trenches for water pipe shall be of such depth as to provide a minimum of 42" of cover unless otherwise shown on the plans.

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The excavation shall not advance more than three hundred (300) feet ahead of the completed and backfilled pipe line. Pipe shall be laid in all trench that has been opened at the end of each day's work, unless the Contractor secures written permission to do otherwise from the Engineer.

If the bottom of the trench becomes an unstable foundation for the pipe through the neglect of the Contractor to adequately shore or dewater, the Contractor will be required to remove the unstable material and backfill the trench to the proper grade with approved compacted gravel, and no extra compensation will be granted for this material or work.

Also, if the trench is inadvertently excavated deeper than necessary it shall be backfilled to the proper grade with approved compacted gravel at the Contractor's expense.

However, if the undisturbed material encountered at the grade depth constitutes, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor will be required to remove such unstable material and backfill the trench to the proper grade with approved compacted material.

The Contractor shall excavate all trenches, including work necessary in working around existing pipe lines or other obstructions. The Contractor shall give notice to the Owners of any such lines or obstructions in order that they may have time to take the necessary precautions for protecting their property. The Contractor shall be responsible for protecting the Owner from any damage from his operations in such work.

In rock, excavation shall be carried three (6) inches below the bottom of the pipe, and loose earth or gravel, thoroughly tamped, shall be used for backfilling to the grade of the bottom of the pipe line.

After inspection of pipelines has been finished on any completed portion of the work the trench may be backfilled. Backfilling shall be accomplished in compliance with the applicable portions of these specifications.

W.4.4. SHEETING, SHORING, AND BRACING

The sides of all excavations shall be sheeted, shored, and braced as deemed necessary by the Contractor so as to try to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the excavation clear of obstructions that will in any way hinder or delay the progress of the work. In wet, saturated, or flowing materials, when it is necessary to install tight sheeting or cofferdams, wood or steel sheet piling of a design and type approved by the Engineer shall be used. All sheet piling, shoring and bracing shall have sufficient strength and rigidity to withstand the pressure exerted and maintain the sides of the excavation properly in place and protect all persons or property from injury or damage. When excavations are made adjacent to existing building or other structures or in paved streets, particular care should be taken to adequately sheet, shore, and brace the sides of the excavation to prevent undermining of, or settlement beneath, the structures or pavement. Underpinning of adjacent structures or pavement shall be done by the Contractor at his own cost and expense in a manner satisfactory to the Engineer and when required by the Engineer. The pavement shall be removed, the void satisfactorily refilled and compacted, and the pavement replaced by the Contractor; the entire expense of such removal and subsequent replacement thereof shall be borne by the Contractor.