CONTRACT DOCUMENTS

AND

SPECIFICATIONS

FOR

PROJECT NO. WPC 26-5
COAL CREEK FEB, PORT SOUTH DIURNAL BASIN, NSWWTP LAGOON 5 & NSWWTP DECANT LAGOON IMPROVEMENTS

ATTENDANCE AT PRE-BID CONFERENCE IS MANDATORY

PREPARED BY:
HOLLOWAY, UPDIKE AND BELLEN, INC.
2001 N WILLOW AVENUE
BROKEN ARROW, OK 74012
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CITY OF TULSA

ERIC LEE, DIRECTOR
WATER AND SEWER DEPARTMENT

Account Numbers:
2731S00007.SewerLines.Sewer.7500.75003305.541101
2731S0004.SewerTreat.Sewer.7500.75003305.541101
7503368-544003

Water and Sewer Department
175 E. 2nd Street, Suite 1300
Tulsa, Oklahoma 74103
(918) 596-9870

TECHNICAL SPECIFICATIONS

PROJECT SPECIFICATIONS

FOR

TULSA METROPOLITAN UTILITY AUTHORITY

PROJECT NO. WPC 26-5

FY'26 WATER POLLUTION CONTROL CAPITAL EQUIPMENT REPLACEMENTS
TULSA, OKLAHOMA

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INTRODUCTION:

200.1 Project work shall include all equipment, labor, materials, hardware, cable, terminations, and incidentals necessary to remove existing equipment that is to be replaced, install the new equipment, and place the new equipment in fully operational, functional, and warrantable service. All equipment to be supplied shall be brand new current year model and not used, remanufactured, or discontinued items.

200.2 The Authority's contact people are:

Water Pollution Control:	Cindy Cantero– Section Manager 175 E. 2nd Street, Suite 1300 Tulsa, OK 74103 918-596-9870 ccantero@cityoftulsa.org
Northside Wastewater Treatment Plant Lower Bird Creek WWTP Port South Lift Station	Colin Wilmering – Northside WWTP and Lower Bird Creek WWTP Superintendent 5628 N 105th East Avenue Tulsa, OK 74117 918-591-4570
Southside Wastewater Treatment Plant Southeast Basin Lift Station	Josh Fisher – Southside WWTP Superintendent 5300 S. Elwood Avenue Tulsa, OK 74107 918-591-4450

201 QUALIFICATION REQUIREMENTS

201.1 Only contractors holding a valid pre-qualification certificate from the Tulsa Metropolitan Utility Authority in Classification A or D, General Utility Constructions, are eligible to bid on this project. No additional qualification information is required to be submitted.

201.2 Only contractors that attend the mandatory pre-bid conference will be allowed to bid on this project.

202 SUMMARY OF BID ITEMS

The Basis of Award shall be determined by the Total Base Bid plus Additive Alternate No. 1. Any proposal submitted incomplete shall be considered non-responsive.

BID ITEM	SPEC NO.	DESCRIPTION
1	203.998	Mobilization
2	203.100/ COT302	Unclassified Excavation and Backfill
3	203.100/ COT330	Temporary Fiber Log and Site Cleanup
4	203.100/ ODOT303	Aggregate Base Type B (Class 57 Clean Rock)
5	203.100	Full-Depth Saw Cut
6	203.100/ ODOT723	#4 Epoxy Coated Rebar, Grade 60, Epoxied in Place
7	203.100/ ODOT723	#5 Epoxy Coated Rebar, Grade 60, Epoxied in Place
8	203.100/ ODOT723	#5 Epoxy Coated Tie Rebar or Dowel, 16″ Long, Grade 60, Existing Drilled & Epoxied In Place
9	203.100/ ODOT701	ODOT AA Concrete
10	203.100/ ODOT	Water Stop (SIKA)
11	203.100/ ODOT	Water Stop (DUMBBELL)
12	203.100/ ODOT	Routine And Cleaning for Basin Joint and Crack Rehabilitation
13	203.100/ ODOT	Tremco 100 Sealant Or Approved Equal, > 1″ Wide Joints
14	203.100/ ODOT	Tremco 100 Sealant Or Approved Equal, ≤ 1″ Wide Joints
15	203.100/ ODOT325	Geotextile Fabric, Mirafi 140NL, 6oz.
16	203.100/ ODOT	Remove & Reinstall Existing Hypalon Liner During Drain Chamber Apron Replacement

17	203.100/ ODOT	Remove & Replace Existing Defective 4″ Floor Relief Valve
18	203.100/ ODOT	Clean And Flush Debris From Existing 30″ Fill/Drain Line
19	203.100/ ODOT	Pressure Wash And Apply Concrete Silox Sealant
20	203.100/ ODOT	Proposed 6 inch Hydrants complete
21	203.100/ ODOT	Paint Existing Hydrants
22	203.100/ ODOT	Replace Light Pole & LED Light fixtures
23	203.100/ ODOT	Remove Vegetation By Hand and Apply Herbicide Between Concrete - Hypalon Liner
24	203.100/ ODOT	Repair Broken Concrete Stairwell Steps
25	203.100/ SP2	Remove & Reinstall Inlet Grates w/ New Stainless Steel Bracket Assemblies Per Details
26	203.100/ ODOT	Clean Asphalt Road Surface
27	203.100/ ODOT	Bituminous Crack Seal (up to 2" wide and pavement depth)
28	203.100/ ODOT	Fog Seal
29	203.200	Port South LS Diurinal Liner Improvements
30	203.300/ ODOT303	Unclassified Excavation and Low Permeability Backfill
31	203.300/ ODOT303	Soil Bentonite Soil Cut off Trench
32	203.300/ ODOT303	Clay Liner
33	203.300/ ODOT303	Driveway Aggregate Base Type A base rock with Geotextile Fabric, Mirafi 140NL, 6oz

34	203.300	Sod
35	203.999	Mechanical, Electrical, Plumbing and Unforeseen Circumstances Allowance for various mechanical, electrical, plumbing, and unforeseen work not shown on the construction drawings or specified in the contract documents.
ADDITIVE ALTERNATE NO. 1		
36	203.400	NSWWTP Decant Lagoon Drain Improvements

END OF SECTION

TMUA PROJECT NO. WPC 26-5
FY'26 WATER POLLUTION CONTROL CAPITAL EQUIPMENT REPLACEMENTS
SPECIFICATION CERTIFICATION SHEET

200 INTRODUCTION

201 QUALIFICATION REQUIREMENTS

202 SUMMARY OF BID ITEMS

203 DESCRIPTION OF BID ITEMS/WORK

203.100 Synthetic Liner
203.300 NSWWTP Lagoon #5 Rehabilitation
203.998 Mobilization
203.999 Unforeseen Mechanical, Electrical and Plumbing

204 ANCILLARY EQUIPMENT & WORK

204.4 General Electrical
204.5 Painting
204.6 Concrete Coating
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214 PAYMENT

END OF SPECIFICATIONS



Stephen Tolar, P.E., S.E.
OK 20679
Holloway, Updike and Bellen, Inc.
C.A. No. 219
Expires June 30, 2027

203.100 SCOPE OF WORK

203.100.1 Furnish and install flexible membrane lining in the areas shown on the drawings. All work shall be done in strict accordance with the project drawings, these specifications and membrane lining fabricator's approved shop drawings.

203.100.2 Geomembrane panels will be supplied sufficient to cover all areas, including appurtenances, as required in the project and shown on the drawings. The fabricator/installer of the liner shall allow for shrinkage and wrinkling of the field panels.

203.100.3 PRODUCTS

203.100.3.1 The lining material shall be 8138 XR-5 as manufactured by Seaman Corporation (1000 Venture Blvd., Wooster, OH 44691; 330-262-1111) with the following physical specifications, or pre-approved equal:

Base (Type)	Polyester
Fabric Weight (ASTM D751)	6.5 oz./yd^2 (1288 +/- 70 g/m^2)
Finished Coated Weight (ASTM D751)	38.0 ±2oz./yd2 (1288 ±70 g/m2)
Thickness (nominal) (ASTM D751)	40.0 mil (1.0mm)
Trapezoid Tear (ASTM D751)	35/35 lb$_f$ (155/155 N) min.
Grab Yield Tensile (ASTM D751, Grab Method Procedure A)	550/550 lb$_f$ (2447/2447 N) min.
Blocking Resistance (ASTM D751, 180°F/82°C)	# 2 Rating max.
Wicking (Shelter-Rite® Procedure)	1/8 in. (0.3 cm) max.
Adhesion - Heat Seam (ASTM D751, Dielectric Weld)	35lb$_f$/2 in. weld (15 daN/5 cm weld) min.
Adhesion - Ply (ASTM D413)	15 lb$_f$/in. (13 daN/5 cm) min. or film tearing bond
Hydrostatic Resistance (ASTM D751, Method A)	800 psi (5.51 MPa) min.
Puncture Resistance (ASTM D4833)	250 lb$_f$ (1112 N) min.
Bursting Strength (ASTM D751 Ball Tip)	650 lb$_f$ (2892 N) min. - 800 lb$_f$ (3560 N) typical
Dead Load (ASTM D751) 70°F (21°C)	210 lb$_f$ (934 N) min.
2" (5 cm) overlap seam, 4 hours, 1" (2.5 cm) strip 160°F (70°C)	105 lb$_f$ (467 N) min.
Bonded Seam Strength *(ASTM D751 Seam Strength as modified by NSF 54)*	575 lb$_f$ (2447 N) min.
Low Temperature (ASTM D2136, 4 hours - 1/8" Mandrel)	Pass @ -30°F (- 35°C)
Weather Resistance (ASTM G23, Carbon Arc)	8,000 hours min. With no appreciable changes or stiffening or cracking of coating
Dimensional Stability (ASTM D1204, 212°F 1 hour, Each Direction)	1.5% max.
Water Absorption (ASTM D741, Section 12, 7 Days)	0.025 kg/m2 max. @ 70°F (21°C) 0.14 kg/m2 max. @ 212°F (100°C)
Abrasion Resistance (ASTM D3389) H-18 Wheel, 1000 g load	2000 cycles (min.) before fabric exposure; 50 mg/100 cycles max. weight loss
Coefficient of Thermal Expansion/Contraction (ASTM D696)	8 x 10^{-6} in/in/°F (1.4 x 10^{-5} cm/cm/°C) max.

203.100.4 SUBMITTALS

203.100.4.1 The fabricator of panels used in this work shall prepare shop drawings with a proposed panel layout to cover the liner area shown in the project plans. Shop drawings shall indicate the direction of factory seams and shall show panel sizes consistent with the material quantity requirements of 1.01. Details shall be included to show the termination of the panels at the perimeter of lined areas, the methods of sealing around penetrations, and methods of anchoring. Placement of the lining shall not commence until the shop drawings and details have been approved by the Owner, or his representative.

203.100.5 FACTORY FABRICATION

203.100.5.1 The individual XR-5® liner widths shall be factory fabricated into large sheets custom designed for this project so as to minimize field seaming. The number of factory seams must exceed the number of field seams by a factor of at least 10.

203.100.5.2 A two-inch overlap seam done by heat or RF welding is recommended. The surface of the welded areas must be dry and clean. Pressure must be applied to the full width of the seam on the top and bottom surface while the welded area is still in a melt-type condition. The bottom welding surface must be flat to insure that the entire seam is welded properly. Enough heat shall be applied in the welding process that a visible bead is extruded from both edges being welded. The bead insures that the material is in a melt condition and successful chemical bond between the two surfaces is accomplished.

203.100.5.3 Two-inch seams must withstand a minimum of 210 pounds per inch width dead load at 70°F and 105 pounds per inch at 160°F as outlined in Mil-T-52983E. All seams must exceed 550 lbs. bonded seam strength per ASTM D-751 bonded seam strength as modified by NSF 54.

203.100.6 INSPECTION AND TESTING OF FACTORY SEAMS

203.100.6.1 The fabricator shall monitor each linear foot of seam as it is produced. Upon discovery of any defective seam, the fabricator shall stop production of panels used in this work and shall repair the seam, and determine and rectify the cause of the defect prior to continuation of the seaming process.

203.100.6.2 The fabricator must provide a Quality Control procedure to the owner or his representative which details his methods of visual inspection and periodic system checks to ensure leak-proof factory fabrication.

203.100.7 CERTIFICATION AND TEST REPORTS

203.100.7.1 Prior to installation of the panels, the fabricator shall provide the owner, or his representative, with written certification that the factory seams were inspected in accordance with Section E. Included one minimum site visit by the Manufacturer technical Representative to provide inspection of completed installation and provide a certified inspection report upon work completion.

203.100.8 PANEL PACKAGING AND STORAGE

203.100.8.1 Factory fabricated panels shall be accordion-folded or rolled onto a sturdy wooden pallet designed to be moved by a forklift or similar equipment. Each factory fabricated panel shall be prominently and indelibly marked with the panel size. Panels must be protected as necessary to prevent damage to the panel during shipment. Panels that have been delivered to the project site should be stored in a dry area.

203.100.9 QUALIFIATION OF SUPPLIERS

203.100.9.1 The fabricator of the lining shall be experienced in the installation of flexible membrane lining and provide the owner or his representative with a list of not less than 5 projects and not less than 1 million square feet of successfully installed XR-5® synthetic lining. The project list shall show the name, address and telephone number of an appropriate party to contact in each case. The manufacturer of the sheet goods shall provide similar documentation with a 10 million square foot minimum. The installer shall provide similar documentation to that required by the fabricator.

203.100.10 SUBGRADE PREPARATION BY OTHERS

203.100.10.1 Lining installation shall not begin until a proper base has been prepared to accept the membrane lining. Base material should be free from angular rocks, roots, grass and vegetation. Foreign materials and protrusions shall be removed, all cracks and voids filled, and surfaces made level or uniformly sloping as indicated on the drawings. The prepared surface should be free from loose earth, rocks, rubble and other foreign matter. Generally, no rock or other object larger that USCS sand (SP) should remain on the subgrades in order to provide an adequately safety factor against puncture. Geotextiles may be used to compensate for irregular subgrades. The subgrade shall be uniformly compacted to ensure against settlement. The surface on which the lining is to be placed shall be maintained in a firm, clean, dry and smooth condition during lining installation.

203.100.11 LINING INSTALLATION

203.100.11.1 Prior to placement of the liner, the installer will indicate in writing to the owner or his representative that he believes the subgrade to be adequately prepared for the liner placement. Scope of work includes scarifying all liner areas (8" depth) and adjacent impacted work areas, fine grading to required uniform slopes and recompact to 95% standard proctor. Remove any rocks larger than 1" that is in contact with the new liner and provide new materials as required and in contact with liner per manufacturer requirements.

203.100.11.2 The lining shall then be placed over the prepared surface in such a manner as to assure minimum handling. The sheets shall be of such lengths and widths and shall be placed in such manner as to minimize field seaming.

203.100.11.3 In areas where wind is prevalent, lining installation should be started at the upwind side of the project and proceed downwind. The leading edge of the liner should be secured at all times with sandbags or other means sufficient to hold it down during high winds.

203.100.11.4 Sandbags or rubber tires may be used as required to hold down the lining in position during installation. Materials, equipment or other items must not be dragged across the surface of the liner or be allowed to slide down slopes on the lining. All parties walking or working on the lining material should wear soft-sole shoes.

203.100.11.5 Lining sheets should be closely fit and sealed around inlets, outlets and other projections through the lining. Lining to concrete seals should be made with a mechanical anchor, or as shown on the drawings. All piping structures and other projects through the lining should be sealed with approved sealing methods.

203.100.12 XR-5 FIELD SEAMING

203.100.12.1 All requirements of Sections D and E apply. A visible bead should be extruded from the hot air welding process. Field fabrication of lining material will not be allowed.

203.100.13 INSPECTION AND TESTING

203.100.13.1 All field seams will be tested using the Air Lance Method. A compressed air source will deliver a minimum of 55 psi to a 3/16-inch nozzle. The nozzle will be directed to the lip of the field seam in a near perpendicular direction to the length of the field seam. The nozzle will be held 4 inches maximum from the seam and travel at a rate not to exceed 40 feet per minute. Any loose flaps of 1/8" or greater will require repair.

203.100.13.2 All field seams should also be inspected utilizing the Vacuum Chamber (ASTM D5641-94) using a 3 to 5 psi vacuum pressure. All leaks shall be repaired and tested.

203.100.13.3 All joints, on completion of the work, shall be tightly bonded. Any lining surface showing injury due to scuffing penetration by foreign objects or distress from rough subgrade, shall be, as directed by the Owner, or representative, replaced or covered and sealed with an additional layer of lining of the proper size, in accordance with the patching procedure.

203.100.13.4 All testing shall be provided by the Contractor as required by the liner manufacturer or manufacturer's representative. Include all inspection reports, certifications and warranty information in the final operation and maintenance manual.

203.100.14 PATCHING

203.100.14.1 Any repairs to the lining should be patched with the lining material. The patch material shall have rounded corners and extended a minimum of our inches (4") in each direction from the damaged area.

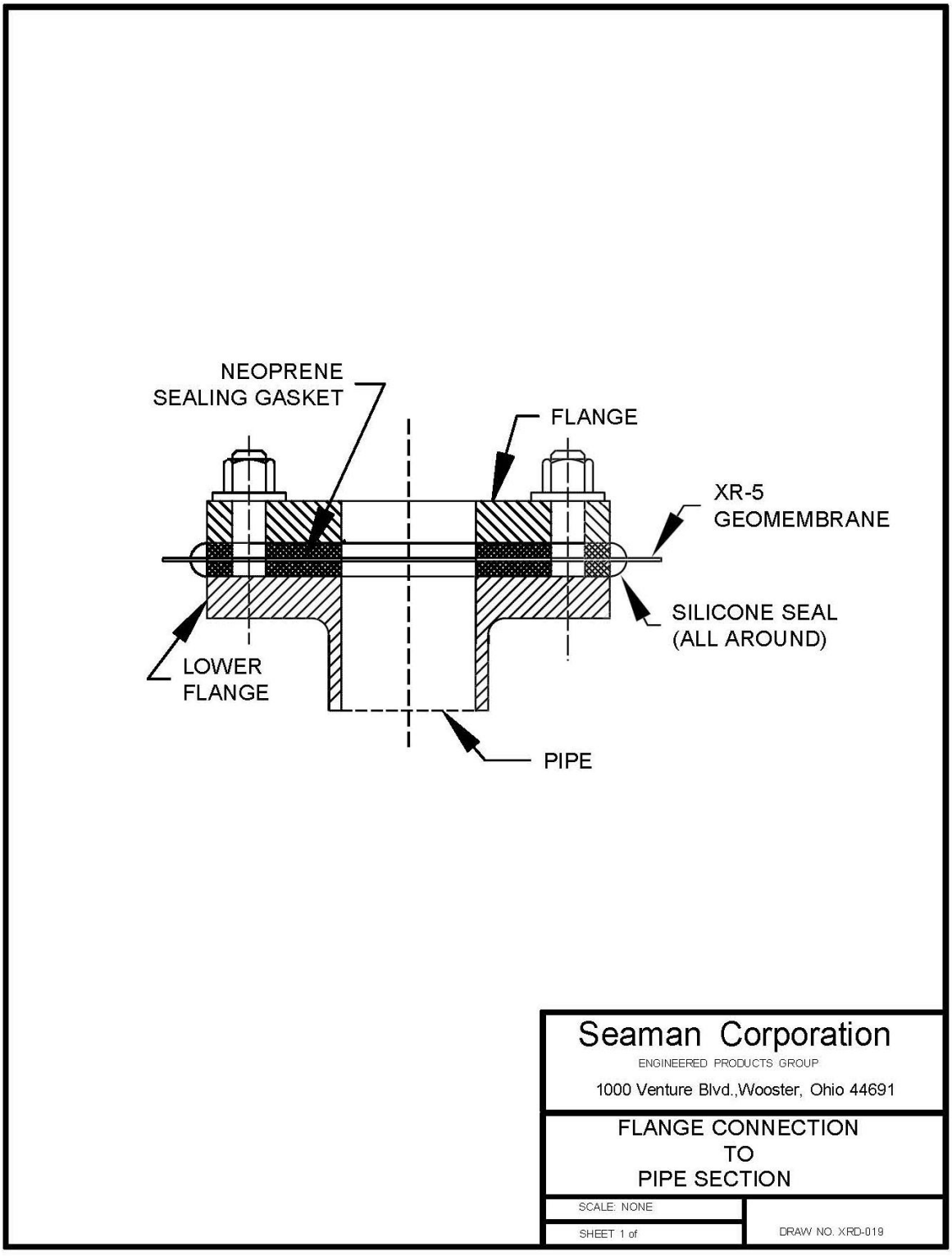
203.100.14.2 Seam repairs or seams that are questionable should be cap stripped of the liner material per manufacturer recommendations.

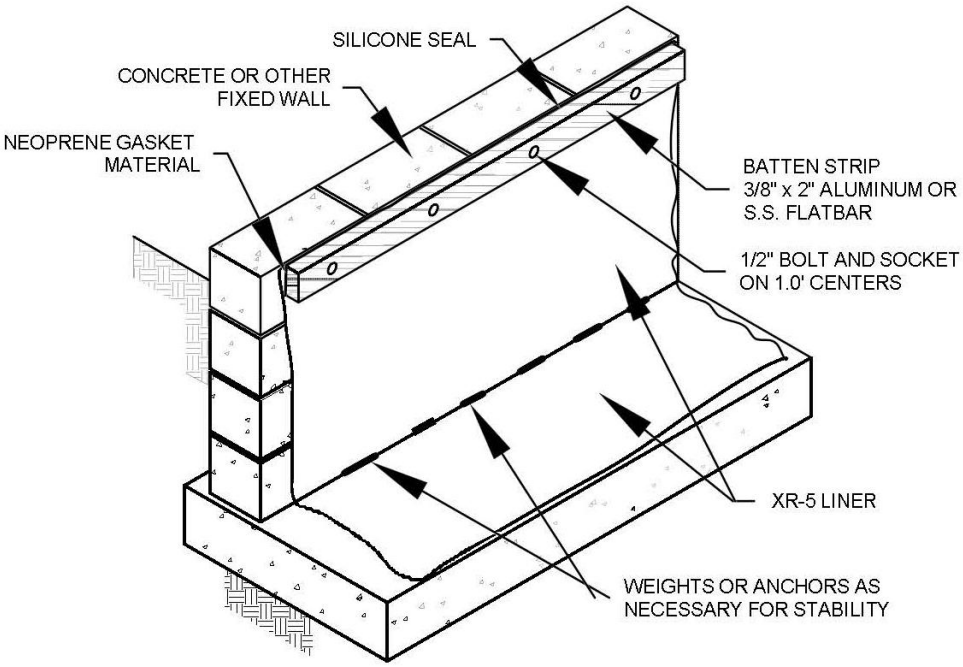
203.100.14.3 The requirements of Section K apply to this cap stripping.

203.100.15 WARRANTY

203.100.15.1 The lining material should be warranted on a pro-rated basis for 10 years against weathering and chemical resistance in accordance with the Seaman Corporation warranty for XR-5® Style 8138. Workmanship of installation should be warranted for one year on a 100% basis.

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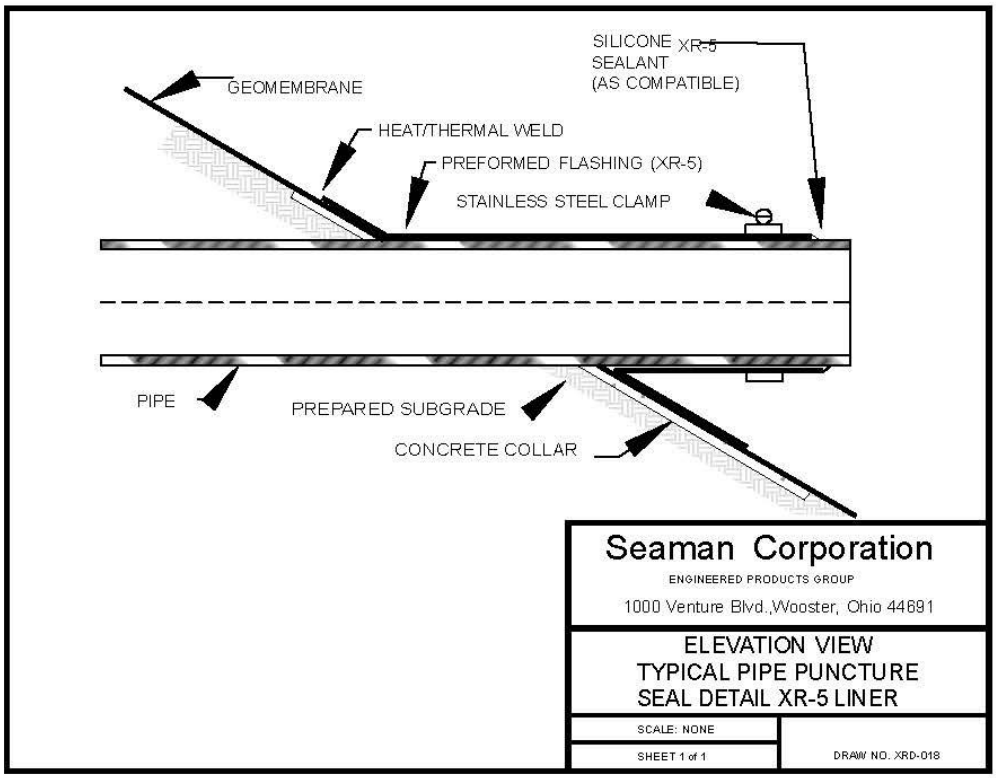

NEOPRENE
SEALING GASKET
FLANGE
XR-5
GEOMEMBRANE
SILICONE SEAL
(ALL AROUND)
LOWER
FLANGE
PIPE
Seaman Corporation
ENGINEERED PRODUCTS GROUP
1000 Venture Blvd.,Wooster, Ohio 44691
FLANGE CONNECTION
TO
PIPE SECTION
SCALE: NONE
SHEET 1 of
DRAW NO. XRD-019

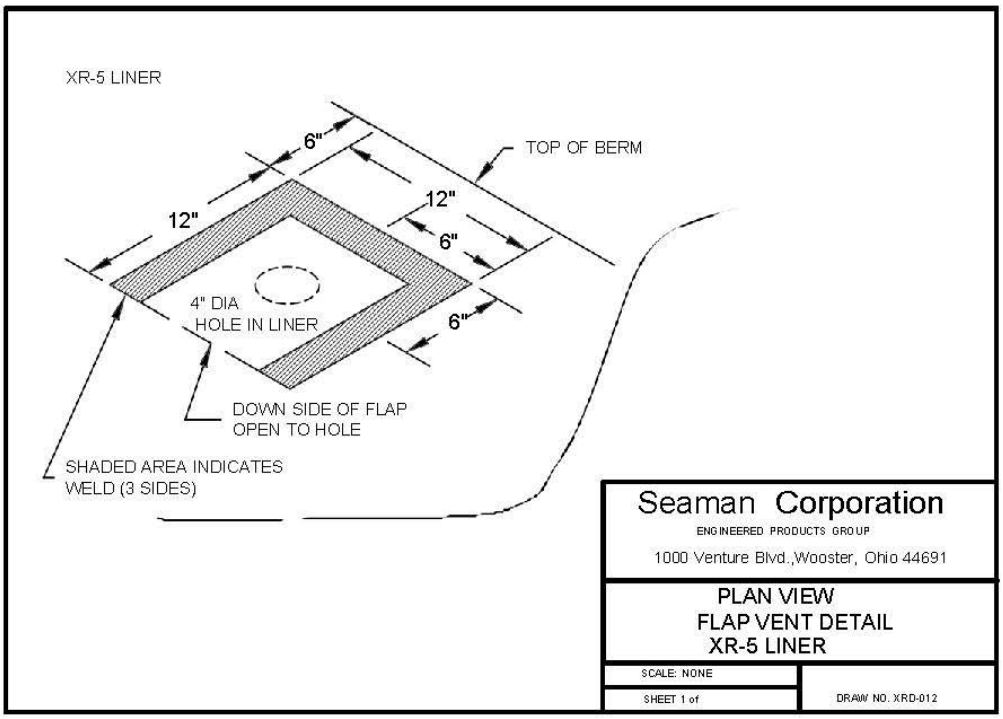


Seaman Corporation
ENGINEERED PRODUCTS GROUP
1000 Venture Blvd.,Wooster, Ohio 44691

ANCHORING DETAIL
XR-5 LINER TO FIXED WALL

SCALE: NONE
SHEET 1 of
DRAW NO. XRD-023





END OF SECTION

203.300 SCOPE OF WORK LAGOON NO. 5 EMBANKMENT REHABILITATION — CONSTRUCTION AND MATERIAL REQUIREMENTS:

203.300.1 SCOPE AND LIMITS: Reconstruct the embankment and install the soil-bentonite cutoff between stations shown in the plan sheets, a nominal length of approximately 700 feet along lagoon #5, within the horizontal limits and to the cross section shown. Furnish excavation, imported low-permeability soil, bentonite, mixing water, material processing, mixing, placement, compaction, construction water control, disposal, restoration, and associated work necessary to complete the rehabilitation.

203.300.2 LAGOON STATUS: The Owner has drained and cleaned the lagoon. The lagoon will remain out of service throughout construction. Coordinate access and construction activities with the Owner. Maintain water control necessary for construction. Notify the Engineer if residual sludge or unexpected waste material is encountered before disturbing or incorporating such material into the work.

203.300.3 GEOTECHNICAL REPRESENTATIVE: The Contractor will provide materials acceptance testing, construction observation, and geotechnical engineering decisions through its designated testing firm. The designated geotechnical engineer will evaluate material qualification results, exposed foundation conditions, cutoff termination, and proposed cutoff loading procedures and recommend acceptance or corrective work to the Engineer. Changes to contract limits, dimensions, or payment require written authorization from the Engineer.

203.300.4 SUBMITTALS AND QUALIFICATION TIMING: Perform material qualification after contract award and before incorporating materials into the work. Submit proposed material sources, representative samples, bentonite product information, mixture proportions, construction sequence, excavation and water-control procedures, and soil-bentonite mixing and placement procedures. Include sufficient time in the construction schedule for laboratory testing, review, and qualification of replacement materials if an initial source or mixture fails. Do not incorporate unaccepted material.

203.300.5 SITE PREPARATION AND PROTECTION: Remove vegetation, roots, organic matter, debris, and unsuitable material within the construction footprint. Segregate reusable road aggregate and topsoil from other excavated materials. Protect existing piping, structures, utilities, and clay liner outside the removal limits. Notify the Engineer of exposed penetrations, animal burrows, voids, or apparent seepage paths. Repair disturbed facilities and liner in accordance with the project details and written direction from the Engineer. Do not incorporate sludge, contaminated material, or unapproved excavated soil into the embankment or cutoff.

203.300.6 EXCAVATION AND FOUNDATION PREPARATION: Remove existing permeable gravel fill within the designated replacement limits and expose underlying native clay. Remove loose, softened, disturbed, and otherwise unsuitable foundation material as directed. Maintain stable excavations and acceptable foundation conditions. Do not place fill on standing water, frozen ground, saturated subgrade or unaccepted surfaces. Owner will identify onsite locations within the plant grounds to broadcast waste materials.

203.300.7 EXISTING CLAY LINER: Carefully remove the existing 8-inch-thick clay liner within the limits necessary for embankment rehabilitation. Segregate and protect salvaged liner material from contamination and mixing with other excavated materials. Following embankment construction, reinstall the liner to a minimum compacted thickness of 8 inches and restore the original grades. Reuse salvaged clay only upon acceptance by the Owner's geotechnical representative; furnish approved replacement clay where salvaged material is unsuitable or insufficient. Place and compact liner material in accordance with the low-permeability embankment fill requirements. Scarify and moisture-condition interfaces to provide a continuous bonded connection with the remaining liner and reconstructed embankment. Obtain acceptance before covering. Include removal, stockpiling, replacement material, reinstallation, compaction, and connections in the lump-sum rehabilitation bid.

203.300.8 CUTOFF TRENCH AND END CONNECTIONS: Construct a continuous cutoff trench at least 3 feet wide, to the indicated 5-foot depth and baseline bottom elevation per plan sheet details, and at least 1 foot into accepted native fine-grained soil. The indicated depth does not waive the required penetration into suitable material.

203.300.8.1 Provide continuous low-permeability connections at both ends of the rehabilitation. Do not terminate the cutoff against unaccepted gravel fill or other permeable material. If suitable termination material is not encountered at the indicated elevation or limits, notify the Engineer and obtain written direction before additional excavation.

203.300.9 FOUNDATION OBSERVATION AND SURVEY RECORDS: Provide at least one week notice before required foundation or trench observation. Do not conceal foundation surfaces, trench bottoms, or end connections before acceptance. Record native-clay contact and trench-bottom elevations at intervals not exceeding 25 feet and at changes in conditions. Reference records to project stationing and survey datum. Submit records before covering the associated work.

203.300.10 LOW-PERMEABILITY EMBANKMENT SOIL: Provide contractor-furnished inorganic lean clay classified CL in accordance with ASTM D2487, meeting the following requirements:

a. Liquid limit: 25 to 50.

b. Plasticity index: 15 to 30, ASTM D4318.

c. Passing No. 200 sieve: at least 50 percent by dry mass.

d. Retained on No. 4 sieve: not more than 10 percent by dry mass.

e. Maximum particle size: 1 inch.

f. Maximum clay-clod dimension before compaction: 1 inch.

g. Maximum saturated hydraulic conductivity: 1 × 10^-6 cm/sec, ASTM D5084.

203.300.10.1 Material shall be free of roots, organic debris, sludge, frozen material, and other deleterious substances. Existing excavated soil may be reused only after qualification and acceptance under these same requirements.

203.300.11 BORROW QUALIFICATION: Provide representative samples for classification, gradation, Atterberg limits, ASTM D698 moisture-density relationship, and hydraulic-conductivity testing for each proposed borrow material.

203.300.11.1 For initial hydraulic-conductivity qualification, test three specimens prepared at 95 percent of ASTM D698 maximum dry density: one at optimum moisture, one at 1.5 percentage points above optimum, and one at 3 percentage points above optimum. Each specimen shall meet the specified hydraulic conductivity. Use effective confining pressure not exceeding 5 psi and hydraulic gradient not exceeding 30. Report specimen preparation, saturation, effective stress, gradient, and final density and moisture.

203.300.11.2 The Owner's geotechnical engineer shall establish post-award strength qualification procedures and evaluate the proposed borrow against the report's modeled embankment undrained shear strength of 1,000 psf. Classification, compaction, and permeability compliance alone shall not establish strength acceptance.

203.300.11.3 Requalify changes in source or materially different soil before use.

203.300.12 EMBANKMENT PLACEMENT AND COMPACTION: Place fill in uniform horizontal lifts not exceeding 8 inches loose or 6 inches compacted thickness. Compact each lift to at least 95 percent of ASTM D698 maximum dry density at moisture contents from optimum through 3 percentage points above optimum.

203.300.12.1. Uniformly distribute moisture and break down clods before compaction. Use kneading compaction equipment suitable for the material. Use thinner lifts where required for confined-area equipment. Scarify and moisture-condition receiving surfaces and construction joints to bond successive placements. Do not cover pumping, cracked, frozen, segregated, or otherwise unacceptable material.

203.300.13 SOIL-BENTONITE BACKFILL MATERIAL: Provide a homogeneous mixture of approved soil, powdered sodium bentonite, and clean mixing water. Provide at least 2.0 percent total dry bentonite by dry mass of soil, including bentonite introduced through slurry. Increase bentonite content as necessary to meet hydraulic conductivity. Document constituent quantities and moisture corrections.The soil component shall contain at least 20 percent passing the No. 200 sieve by dry mass and no particles greater than 1 inch. The completed mixture shall meet:

a. Maximum saturated hydraulic conductivity: 1 × 10^-6 cm/sec, ASTM D5084.
b. Placement slump: 4 to 6 inches, using ASTM C143/C143M apparatus and procedure.

203.300.13.1 Cement, cementitious slurry, and ordinary flowable fill are not permitted substitutes. Embankment Proctor-compaction requirements do not apply to soil-bentonite backfill.

203.300.14 SOIL-BENTONITE QUALIFICATION AND COMPATIBILITY: After award, qualify three independently prepared trial batches using the proposed soil, bentonite, and mixing water. Each batch shall meet the specified slump and hydraulic conductivity. Prepare permeability specimens to represent placed backfill without Proctor compaction.

203.300.14.1 The Owner's geotechnical engineer shall establish the laboratory consolidation, effective-stress, and compatibility-testing procedures before testing. Evaluate contact with

representative liquid or supernatant from the digested solids stored in Lagoon No. 5 and site groundwater expected to contact the cutoff. Coordinate representative liquid sampling with the Owner. Hydraulic conductivity following compatibility exposure shall not exceed 1 × 10^-6 cm/sec. Clean-water testing alone shall not establish chemical compatibility.

203.300.14.2 Requalify changes in constituent sources or mixture proportions before use.

203.300.15 SLURRY PREPARATION AND BACKFILL PLACEMENT: Where bentonite slurry is used, hydrate for at least 8 hours before use unless a shorter period is demonstrated and accepted through qualification testing. Initial slurry shall have a Marsh-funnel viscosity of at least 40 seconds.

203.300.15.1 Where backfill placement displaces trench slurry, soil-bentonite backfill density shall exceed trench-slurry density by at least 15 pcf. Maintain trench stability and remove loose sediment, debris, and sloughed material before placement.

203.300.15.2 Place backfill continuously by an accepted procedure that prevents segregation, trapped slurry, and unfilled zones. Do not free-drop backfill through standing trench slurry. Do not add plain water to adjust consistency unless included in the qualified mixture procedure. Maintain continuous contact with accepted trench surfaces and previously placed backfill.

203.300.16 CUTOFF-TO-EMBANKMENT CONNECTION Protect soil-bentonite against drying, erosion, contamination, and displacement. Remove segregated surface material and maintain continuous low-permeability contact with overlying embankment fill.

203.300.16.1 Do not operate compaction equipment directly on exposed soil-bentonite. Before placing overlying embankment, obtain the Engineer's release of the initial cover placement, equipment loading, and construction sequence based on the Owner's geotechnical engineer's evaluation of cutoff displacement and settlement. Do not substitute an arbitrary elapsed waiting period for this evaluation.

203.300.17 WATER CONTROL AND WEATHER PROTECTION: Divert runoff and control seepage and groundwater sufficiently to maintain acceptable excavation and placement conditions. Prevent erosion and migration of soil fines during water control. Handle and discharge collected water at locations accepted by the Owner and in accordance with contract requirements.

203.300.17.1 Protect exposed native clay, accepted fill, and construction joints against drying, cracking, erosion, freezing, and saturation. Recondition or replace damaged material before covering.

203.300.18 OWNER ACCEPTANCE TESTING: The Contractor shall provide acceptance testing at the following minimum frequencies, with additional tests at material changes or questionable conditions:

a. Embankment density and moisture: one test per 2,500 square feet of each lift, with at least three tests per lift. Distribute tests among the center, sides, and end connections. Determine density by ASTM D6938 or D1556/D1556M and moisture by ASTM D2216 or a correlated field method.

b. Borrow gradation and Atterberg limits: one set per 2,000 cubic yards, with at least one set per source and each material change. Establish a new compaction curve where existing data are unrepresentative.

c. Compacted-fill hydraulic conductivity: one intact sample per 1,000 cubic yards, with at least three samples over the project. Repair sampling locations with accepted compacted clay.

d. Soil-bentonite slump and density: at startup, at least twice per shift, and after mixture adjustments.

e. Soil-bentonite hydraulic conductivity: one production sample per 100 cubic yards or each placement day, whichever produces more samples, with at least three samples over the project. Sample immediately before placement.

203.300.18.1 Identify the location, elevation, date, and material represented by each test. The Contractor shall provide access, coordination, samples, and assistance necessary for Owner to witness all testing as required.

203.300.19 NONCONFORMING WORK: Do not cover rejected work. Rework or replace deficient material and obtain acceptance before proceeding. Where laboratory results remain pending, identify the affected placement and obtain written authorization before covering; such authorization does not constitute final acceptance.

203.300.20 RESTORATION AND COMPLETION: Restore the crest road with an 8-inch-thick section of 1-1/2-inch Type "A" aggregate and restore disturbed road areas as shown. Sod disturbed unpaved areas designated for vegetation. Complete erosion protection, repair disturbed facilities and liner, and remove surplus materials and debris.

203.300.20.1 Submit final survey information, trench records, material approvals, mixture records, and testing documentation. Complete corrective work before requesting final acceptance. The Owner will authorize return of the lagoon to service.

203.300.21 MEASUREMENT AND PAYMENT: Include all work shown and specified in the bid items for lagoon embankment rehabilitation, including material procurement, hauling, processing, excavation, mixing, placement, compaction, construction water control, disposal, protection, and restoration. Include Contractor coordination, sampling assistance, production controls, and qualification submittals.

203.300.21.1 Engineer-directed changes beyond the defined bid limits shall be administered under the contract's changes and differing-site-condition provisions.

203.998 Mobilization Bid Item – A mobilization bid item is included to help cover initial costs of bonds, insurance, permits, submittal preparation and other incidental costs.

203.998.1 Payment shall be made for a Mobilization Bid Item which is intended to cover the costs of bonds, insurance, permits, submittal preparation and other incidental costs. Payment of the Mobilization Bid Item may be requested in full on the first payment application. The Mobilization Bid Item shall not exceed five percent (**5%**) of the **sum of all Base Bid Items excluding the Mobilization Bid Item**. Add Alternate Items are not part of the Base Bid Items.

END OF SECTION

203.999 Mechanical, Electrical, Plumbing, and Unforeseen Circumstances Allowance – The allowance amount is shown on the bid proposal for various mechanical, electrical, plumbing, or unforeseen circumstances work not shown on the Construction Drawings or specified in the Contract Documents.

203.999.1 The allowance shall be used for cost of materials, labor, installation, and overhead and profit for additional MEP/Unforeseen Circumstances work that is not shown on the Construction Drawings or specified in the Contract Documents.

203.999.2 The allowance shall be used only at the discretion of the City of Tulsa. Any allowance balance remaining at the completion of the contract will be credited back to the City of Tulsa on the final Application for Payment submitted by the contractor.

203.999.3 The contractor shall provide to the City of Tulsa representative a written request for the use of any of the allowance with a schedule of values and all associated backup information.

203.999.4 The contractor shall proceed with work included in the allowance only after receiving a written order from the City of Tulsa representative authorizing such work. Proceeding with work expected to be covered in the allowance without a written order from the City of Tulsa representative will be at the contractor's risk. Contractor may not be paid for unapproved work/materials at the discretion of the City of Tulsa representative.

203.999.5 Any additional costs for bonds and insurance shall not be included in any MEP allowance because this cost is already included in the contract.

END OF SECTION

204 ANCILLARY EQUIPMENT & WORK

The cost of items in this Section and other Sections of these specifications shall be equitably included in the appropriate Bid items.

204.1 Prior to disposal of any material or equipment that is City of Tulsa property and removed as part of the contract work, Contractor shall contact the appropriate **WWTP Plant Superintendent** and explicitly offer to the Authority first right to claim and retain such materials or equipment as City of Tulsa property. Contractor shall be responsible for the disposal of all such equipment and materials not claimed by the Authority. Items identified for salvage shall be removed carefully, protected, palletized and delivered to the Northside or Southside Maintenance Department. A copy of the Contractor's transmittal shall be provided to the Engineer after delivery.

204.2 Contractor shall field verify all elevations and dimensions of existing piping, valves, and equipment to be demolished. Contractor work shall be based on field measurements and shall include field adjustments and additions for the proper installation of equipment. The contractor shall take note of all objects in the vicinity of equipment being installed to ensure that there are no issues with interference. It is the responsibility of the contractor to make modifications necessary to adjacent objects such as pipe supports and similar to install the new equipment unless such objects are not reasonably visible during the site visit. It is the responsibility of the contractor to review all field conditions and take necessary field measurements prior to ordering equipment. The City of Tulsa will make available the information it has pertaining to the existing equipment.

204.3 General Equipment Requirements:

204.3.1 Approved Equal Equipment: The manufacturers and models specified in the equipment specifications are considered pre-approved. The winning contractor may, at their discretion, submit for approval equipment that has not been approved prior to the bid opening. When doing this, the contractor should be aware that the submitted equipment must not only meet the performance requirements stated in the equipment specifications, but it also must meet or exceed the manufacturing, material, and quality specifications of the pre-approved equipment even though those specifications are not expressly listed in the section. The Engineer will review any non pre-approved equipment through the submittal process and compare it with the pre-approved equipment to determine that the equipment is or is not equal. Contractor should be

prepared to supply technical data, material information, standards conformance information, and other related information as requested by the Engineer. If the requested information is not supplied, the equipment will be deemed to be not equal. Approval of non pre-approved equipment will be at the sole discretion of the Engineer.

204.3.2 Equipment Demolition: All equipment shall be demolished in accordance with each bid item section. No existing equipment is to be abandoned in place unless specifically noted otherwise. All equipment being removed during demolition shall either be set aside for determination of surplus value or disposed of by the contractor per each bid item specification. If after removing the old equipment and installing the new equipment there are unused items still in place, it shall be the responsibility of the contractor to remove these items in a manner that will not affect adjacent equipment or systems. All removed electrical and fluid components shall be properly capped off at the point of removal. Removal shall be performed in a manner that will allow re-installation/replacement of the removed items at a later date if necessary.

204.3.3 Gauges: Each pump shall be provided with a combination pressure/vacuum gauge in the suction piping and a pressure gauge in the discharge piping. Gauges shall conform to ANSI/ASME B40.1 and shall be indicating dial type, with C-type phosphor bronze Bourdon tube and stainless steel rotary geared movement, or direct drive type with stainless steel helical-wound capillary tube pressure sensing element. The gauge shall have a phenolic open front turret case, and adjustable pointer, a stainless steel or phenolic ring, and an acrylic or shatterproof glass window. The dial shall be 4 ½ inches in diameter, with white background and black markings. Pointer travel shall span not less than 200 degrees or more than 270 degrees. All gauges shall be Accuracy Grade A or better. Pressure gauges shall read in pounds per square inch. Compound gauges shall read in inches of mercury vacuum and pounds per square inch. The range of each gauge shall be per pump manufacturer's recommendation.

All gauges shall be installed with a diaphragm seal, brass flushing port and brass isolation valve of appropriate size.

204.3.4 Mechanical Seals and Seal Water:

204.3.4.1 All pumps shall be equipped with cartridge mounted double mechanical seals recommended by the pump manufacturer and compatible with Pump Seal Water Support Systems (PSWSS) installed at each pump. Refer to Construction Drawings and pump specifications for additional requirements.

204.3.4.2 The new seal water conditioning station (SWCS) and PSWSS may contain components that were not originally part of an existing seal water system. It is the responsibility of the contractor to supply and install all necessary electrical components including wiring, conduit, connectors, contactors and appurtenances required for the complete installation of the new seal water system. It may also be necessary to integrate the new seal water system components into the existing equipment control system. The contractor shall be responsible for all labor and materials required to integrate new components into the existing control system. All electrical work on the seal water station shall conform to the General Electrical Requirements herein. Contractor shall demolish and remove all existing seal water components not reused in construction.

204.3.4.3 Seal water piping and accessories shall not utilize rigid PVC piping. Seal water lines connected directly to the mechanical seals shall be PEX. All other piping in the seal water station shall be of a non-corrosive metal material such as stainless steel, or painted copper. Valves and other components shall be bronze unless otherwise required.

204.3.4.4 Some existing pumps do not have mechanical seals. Contractor shall determine from field investigations the location of seal water for those pumps. It is the responsibility of the contractor to supply and install all seal water piping, electrical work and materials, and control work and materials required to add a seal water station where one was not used for existing equipment. Locations are to be approved by the engineer.

204.3.4.5 If a new pump is installed that does not require seal water and there are existing seal water lines at the pump location, it is the responsibility of the contractor to remove existing water lines. Lines shall be removed as far up stream as possible to a point that will not interfere with water supply to other equipment. No existing lines shall be abandoned in place.

204.3.5 Valves:

204.3.5.1 All valve parts and surfaces shall be of corrosion resistant materials or have a factory applied epoxy coating sufficient to prevent corrosion in a wastewater environment. See painting/coating section for coating thickness requirements.

204.3.5.2 Plug Valves and Check Valves: Plug valves and check valves shall be of the same size, style and construction as the units being replaced. It is the responsibility of the contractor to review the existing valves and provide correct similar units. Acceptable manufacturers are Pratt, DeZurik, Clow, Val-Matic, or an approved equal.

204.3.5.3 Butterfly Valves: Butterfly valves shall be of the same size, style, and construction as the units being replaced. It is the responsibility of the contractor to review the existing valves and provide correct similar units. Acceptable manufactures are DeZurik, Clow, Val-Matic, or an approved equal.

204.3.5.4 Gate Valves: Gate valves shall be of the same size, style and construction as the units being replaced. It is the responsibility of the contractor to review the existing valves and provide correct similar units. Acceptable manufacturers are Wey, DeZurik, or approved equal.

204.3.5.5 Plug and butterfly valves supplied with hand wheel operators that are installed more than 6'-0" above floor level shall be supplied with chain wheels and chains to allow for valve operation from the floor.

204.3.5.6 Valves and operators shall be selected by the contractor such that when installed in close proximity to one another

the operators will be a sufficient distance apart to allow for uninhibited use by personnel.

204.3.5.7 All Valve placement and orientation shall be installed per Manufacture's recommendations. Systems operation and valve orientation layout (drawing) shall be included in the submittals for review with valve submittal(s).

204.3.6 Equipment Tagging: New equipment shall be tagged, according to the requirements listed below and City standards, with a permanent and visible tag showing the new equipment number and naming using the City of Tulsa Equipment ID numbering system. All tags should be visible to anyone without the need to remove covers or otherwise "hunt" for the tag. See individual equipment sections for Equipment ID numbers for each item. Tags shall conform to the following specifications.

204.3.6.1 Requirements:

- Any equipment valued over $1,000

- All Valves greater than 6"

- All valves great than 2" buried. Concrete collar tags for valves require a 316 stainless steel tag at each installed location. See valve box concrete collar detail for additional required details.

- All relief and motorized valves that are smaller than 6"

- Any equipment that requires preventive maintenance

- Any equipment that is critical to the process of the plant

- Any equipment that is considered a Safety item

- Emergency Eyewash/Showers

- All Fire Extinguishers

- All Ladders

- Hoists

- All Detectors

- Overhead Doors

- Fire Alarms/Sprinklers

- Emergency Lights

- All electrically powered devices require three (3ea) tags at minimum - one at unit, one on the disconnect and on panel/switch/MMC bucket.

- All equipment with assigned Equipment number

- All mechanical, heating, ventilation and cooling system equipment. Each unit and item of maintenance location shall be tagged individually, along with each component within the system in other areas of the building/facility. Custom engrave (bi-laminated) plastic sleeved tags with equipment numbers, naming and direction arrows for each piping, refrigerant lines, condensate, drain lines and system lines shall receive a label every 6 LF at min which can be readable from below or system access point.

204.3.6.2 Equipment ID tagging shall meet the following requirements:

PRODUCTS

Equipment ID Number and Name Tagging Plates

All equipment tagged on the drawings, except for buried submerged equipment shall be provided with an Equipment ID Number Plate bearing the equipment tag number and equipment name. Each equipment ID Plates shall be rectangular 3.5"x .75" and 1/16" thick laminated blue phenolic plastic engraving stock that is U/V stable. Lettering shall be 1 line of text, centered, and white capitalized block letters .25" high and engraved to a depth of 0.08mm.

Equipment ID Number Plates must follow the Equipment ID numbering and naming scheme. Each equipment or systems should also include an additional tag noting the general name of the equipment or system adjacent to the equipment ID numbering tag (i.e., "Final Clarifier #3", VFD for Pump #2, etc.).

Equipment ID Number Plates shall be attached with permanent adhesive or stainless fasteners.

Additional Number Plates shall be provided for ancillary devices associated with each piece of new tagged equipment.

Additional tags shall be provided for all electrical disconnects, variable frequency drives, switching and Motor Control Centers whether new or existing.

VALVE, BUTTERFLY AND GATE EQUIPMENT ID NUMBER AND NAME TAGGING PLATES

Equipment ID Number and Name Plates

Additional details for all valves and gates, except buried or submerged valves, that have been assigned an Equipment ID number on the Drawings or in the valve or gate schedule, shall be provided with a permanent number plate. Equipment ID Number Plates shall be round 1.5" and 1/16" thick laminated blue phenolic plastic engraving stock that is U/V stable. Lettering shall be in 3 sections, centered, and white capitalized block letters 3/16" high and engraved to a depth of 0.08mm.

Example: 1st line XXXX-

2nd line XXXX-

3rd line XXXXX

Equipment ID Number Plates must follow the Equipment ID numbering and naming scheme. Reference the project equipment warranty log for additional information.

Equipment ID Number Plates shall be attached with permanent stainless cable ties or stainless fasteners. Plated or coated fasteners will not be permitted.

See contract drawings for all buried valves concrete collar details and special custom stainless steel tagging requirements (Seton or equal). All buried valves 2" and greater require an engraved stainless-steel tagging with system name/valve information and equipment number. See plan sheet detail as required for additional requirements.

204.3.7 Equipment Coatings: All equipment shall be supplied with a factory applied coating sufficient to withstand a wastewater environment. Factory applied coating shall be in accordance with the painting/coating section.

204.3.8 Equipment Installation: All anchor bolt connections shall include the use of a washer, lock washer, and nut (without nylon or similar insert).

204.3.8.1 Installation of all equipment and related items shall be performed as directed in the manufacturer's installation instructions.

204.3.8.2 No cutting, drilling or welding of new equipment or part thereof as delivered from the manufacturer for the purpose of adapting or modifying said unit to facilitate its installation will be permitted without written prior approval by the authority.

204.3.8.3 The Contractor shall be responsible for any and all concrete modifications that may be required to install the new equipment. This shall include modifications or replacement of equipment pads and supports. All modifications shall be designed and constructed to conform to the recommendations of *ACI 302.1R-04 Guide for Concrete Floor and Slab Construction* and *ACI 301-10 Standard Specifications for Structural Concrete*. All concrete modifications and repairs shall be coated per the painting/coating section herein.

204.3.9 Equipment Start Up and performance:

204.3.9.1 All new equipment installed by the contractor must be started up and be in operational service for 48 hours with no performance issues prior to demolishing and installing like, adjacent equipment in the same system. If the new equipment exhibits any performance issues, the contractor shall repair the equipment/installation as required and begin a new 48 hour observation period.

END OF SECTION

204.4 General Electrical Requirements

204.4.1 Electric Code Compliance: All electrical work shall be performed in compliance with current electrical code.

204.4.2 Electrical Disconnects: All equipment installed or worked on with an electrical portion in the scope of work shall have a new local disconnect switch installed unless specially noted otherwise on a specific plan sheet. All local disconnect switches shall be of 316 stainless steel construction meeting NEMA 4X standards. In the event a Class 1, Division 1 rating is required for explosion proof service, the disconnect shall meet all required ratings for Class 1, Division 1 service. Control panels that incorporate an integral disconnect will not be required to have an external disconnect.

204.4.3 Electric Motors: All electric motors shall be premium efficiency, suitable for operating the intended equipment per the equipment manufacturer's recommendations.

204.4.4 Electrical Wiring & Related Items: Contractor shall use caution to avoid damage to existing power cables. These cables shall be reused in new equipment installation provided their reuse meets current code requirements. Contractor shall be responsible for any damage to existing electrical equipment or power cables. The contractor shall be responsible for removing the existing control system and replacing it with the new control system. No unused remnants of the existing control system shall be abandoned in place.

204.4.5 Identification: Conduits in manholes, hand-holes, building entrance pull boxes, junction boxes and equipment shall be provided with identification tags. Identification tags shall be 19 gage stainless steel with ½ inch stamped letters and numbers as indicated on the drawings. Identification tags shall be attached to conduits with nylon tie wraps and shall be positioned to be readily visible.

204.4.6 Rigid Steel Conduit shall be heavy wall, plated/hot-dip galvanized, shall conform to ANSI C80.1, and shall be manufactured in accordance with UL 6. Not applicable to this contract unless specifically noted otherwise.

204.4.7 Liquid tight Flexible Metal Conduit shall be hot-dip galvanized steel, shall be covered with a moisture proof polyvinyl chloride jacket, and shall be UL labeled. For interior applications only.

204.4.8 Rigid Nonmetallic (PVC) Conduit - PVC conduit shall be heavy wall, Schedule 40, UL labeled for aboveground and underground uses, and shall conform to NEMA TC-2 and UL651. Not acceptable and not applicable to this contract.

204.4.9 Aluminum Rigid Conduit system:

204.4.9.1 The conduit shall be rigid aluminum, threaded, T-1 temper as part of electrical of an all-aluminum conduit system with couplings, bends and fittings as required. Any fasteners and other hardware shall be 316 stainless steel as required and applicable. In the event a Class 1, Division 1 rating is required for explosion proof service, the conduit system shall meet all required ratings for Class 1, Division 1 service. Provide in all interior and exterior installation locations.

204.4.9.2 The conduit system shall be UL 6A and ANSI C80 5 rated for application.

204.4.9.3 Provide "seal-off" corrosion protection at all and panels, device outlets and equipment as recommended by conduit Manufacture.

204.4.9.4 Acceptable manufactures are Wheatland Tube, Republic Conduit, and American Conduit by Sapa or equal.

204.4.9.5 Unless a Manufacturer requirements, code or other governing requirement specifically require something other than aluminum conduits, all conduits and accessories shall be aluminum with 316

204.4.9.6 All aluminum in contact with concrete shall be coated or have isolation to the concrete to minimize corrosion.

204.4.9.7 All fasteners, bolts, screws, anchor bolts and other related components to support the aluminum conduit system shall be 316 stainless steel.

204.4.10 Conductors. All conductors in power, control and instrumentation circuits shall be identified and color coded as described herein.

204.4.10.1 Conductor Identification Number. Except for lighting and receptacle circuits, each individual conductor in power, control and instrumentation circuits shall be provided with wire identification markers at the point of termination.

204.4.10.2 The wire numbers shall be of the heat-shrinkable tube type, with custom typed identification numbers.

204.4.10.3 The wire numbers shall be as indicated on the equipment manufacturer's drawings.

204.4.10.4 The wire markers shall be positioned to be readily visible for inspection.

204.4.11 Conductor Color Coding. Power conductors shall be color coded as indicated below. For conductors 6 AWG and smaller, the color coding shall be insulation finish color. For sizes larger than 6 AWG, the color coding may be by marking tape. The equipment grounding conductor shall be green or green with one or more yellow stripes if the conductor is insulated.

204.4.11.1 The following color coding system shall be used for Power conductors:

204.4.11.1.1 120/240V, single-phase – black, red and white

204.4.11.1.2 120/208V, three-phase – black, red, blue and white

204.4.11.1.3 120/240V, three-phase – black, orange, blue and white

204.4.11.1.4 277/480V, three-phase – brown, orange, yellow and gray

204.4.11.1.5 Where 120/240 and 120/208 volt system share the same conduit or enclosure, the neutral for either the 120/240 volt system or the 208 volt system shall be white with a permanent identifiable violet stripe.

204.4.11.2 Control and instrumentation circuit conductors shall be color coded as indicated below:

204.4.11.2.1 Multiconductor Control Cable: 600 Volt Multiconductor 14 AWG Control Cable

204.4.11.2.2 REFERENCE: UL 83, UL 1277, ICEA S-73-532, ICEA S-58-679.

204.4.11.2.3 CONDUCTOR: 14 AWG, 7 OR 19 strands, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

204.4.11.2.4 INSULATION: Polyvinyl chloride, not less than 15 mils average thickness;13 mils minimum thickness, UL 83 Type THHN and THWN.

204.4.11.2.5 SHIELD: None.

204.4.11.2.6 JACKET: Conductor: Nylon, 4 mils minimum thickness, UL 83.

204.4.11.2.7 Cable assembly: Black, flame-retardant polyvinyl, UL 1277, applied over tape-wrapped cable core.

204.4.11.2.8 COLOR INDENTIFICATION: ICEA S-58-679, Method1, Table 2 or ICEA S-58-679, Method 3, Table 2. White or green conductors shall not be provided. A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches. Marking shall include manufacturer's name, Type THWN or THHN, conductor size, number of conductors, and voltage class.

204.4.12 Signal Control Cable:

204.4.12.1 REFERENCE: UL 62, UL 1277.

204.4.12.2 CONDUCTOR: 16 AWG,7-strand, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

204.4.12.3 INSULATION: Polyvinyl Chloride, not less than 15 mils average thickness: 13 mils minimum thickness, UL 62, Type TFN.

204.4.12.4 LAY: Twisted pair with 1-1/2 inch to 2-1/2 inch lay.

204.4.12.5 SHIELD: Cable assembly, combination aluminum-polyester tape and 7-strand, 20 AWG minimum size, tinned copper drain wire, shield applied to achieve 100 percent cover over insulation conductors.

204.4.12.6 JACKET: Conductor. Nylon, 4 mils minimum thickness, UL 62.

204.4.12.7 Cable assembly: Black, flame-retardant polyvinyl chloride, UL 1277, applied over tape-wrapped cable core.

204.4.12.8 CONDUCTOR IDENTIFICATION: One conductor black, one conductor white.

204.4.13 Single Conductors: 600 Volt, Single Conductor Power Cable

204.4.13.1 REFERENCE: UL 83, ICEA S-95-658 (NEMA WC 70).

204.4.13.2 CONDUCTOR: Stranded, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

204.4.13.3 INSULATION: Polyvinyl, UL 83, type THHN and THWN, ICEA S-95-658.

204.4.13.4 SHIELD: None

204.4.13.5 JACKET: Conductor. Nylon, 4 mils minimum thickness, UL 83.

204.4.14 Pump Control Panels (Cabinets) – Unless otherwise noted, Contractor shall provide each unit with the following system components to conform to the following specifications:

204.4.14.1 Input Disconnect: Furnish an input circuit breaker with an interrupting rating of 65,000 rms symmetrical amperes.

204.4.14.2 Control Devices: Include door mounted control and monitoring devices for each sump pump as follows:

A. "Manual-OFF-Auto" control selection

B. Power disconnect

C. Elapsed time meter; shall be non-resettable, rollover at 9999 hours showing resolution of 0.1 hours

D. Phase loss monitor

E. Indicator lamps for Power On, Run, Phase Loss and Overload.

204.4.14.3 NEMA contactors size 1 or larger rated to handle the connected load.

204.4.14.4 Refer to Drawings for control panel schematics for additional requirements.

204.4.14.5 Coil Voltage: 120-volts, 60-hertz.

204.4.15 Variable Frequency Drives (VFD):

204.4.15.1 Enclosures: New VFD units shall be supplied with and installed in a new enclosure. All component enclosures shall be NEMA 12 compliant, and shall fit in the location of replaced equipment.

204.4.15.2 System Features: Contractor shall provide each unit with the following system components to conform to the following specifications:

204.4.15.3 Input Disconnect: Furnish an input circuit breaker with an interrupting rating of 65,000 rms symmetrical amperes

204.4.15.4 The VFD units must comply with all requirements of the existing pumps. The new VFD units shall be 18 pulse "clean power", low harmonic in compliance with IEEE 519 guidelines for harmonic mitigation and have a continuous output current of approximately 30% more than the motor full load nameplate current.

204.4.15.5 New VFD units shall be installed with no cutting, drilling or welding of the new equipment or part thereof as delivered from the manufacturer, for the purpose of adapting or modifying said unit to facilitate its installation, will be permitted without written prior approval by the Authority.

204.4.15.6 Control Devices: Include door mounted control and monitoring devices for each drive as follows:

Start push button

Stop push button

"Local-OFF-Remote" control selection

Maintained Emergency shutdown button – Palm press and red in color

Speed selection – Door mounted potentiometer operating single turn 0% - 100%

Frequency meter with hertz and 0-100 scales

Output ammeter

Elapsed time meter shall be non-resettable, rollover at 9999 hours showing resolution of 0.1 hours

Diagnostic package with fault indication and reset push button

Indicator lamps for the ON, OFF, Auto, Vibration and FAULT unit status conditions

Vibration sensors shall be installed and operated such that when a vibration alarm is triggered, the VFD/Pump shuts down automatically

Vibration sensors shall have the operating capacity of sending a 4-20 mA signal to an analog PLC input and a dry set of contacts for the relay logic

204.4.15.7 PLC Control Features: Furnish a control system for each drive to allow the following Auto/PLC functions:

Remote, isolated 4-20 mA speed control input

Isolated 4-20 mA speed output

PLC Remote Run command

Alarm outputs

ON/OFF status output

Additional features and controls specified with the drive equipment

Local/Auto status output

204.4.15.8 New and replacement VFDs shall be installed such that all 4-20mA features are available. If a VFD being replaced is not currently configured to communicate with the SCADA system, the replacement unit shall communicate with the SCADA system in the same manner of a new VFD installation. On new VFD installations, all 4-20mA communication features shall be installed in the VFD for future connection to the SCADA system. All function and options which are included in the new VFD shall be integrated fully into the City's SCADA system, including SCADA screen(s).

204.4.15.9 General Purpose Contactors: Provide general purpose contactors in accordance with NEMA ICS 2 meeting the following:

Coil Voltage: 120-volts, 60-hertz

Poles: Provide three-pole contactors, unless otherwise indicated.

204.4.15.10 Electrical Wiring: Contractor shall be responsible for verifying or replacing all wiring from existing breakers and/or disconnects to the new equipment including replacing breakers as required. All wiring and electrical construction shall meet current electrical code.

204.4.15.11 Complete O&M Manuals and operating parameters shall be supplied on CD.

204.4.15.12 Electrical Wiring & Related Items:

204.4.15.13 All wire to wire connections shall be made using insulated mechanical connectors. All shielded cable shall use heat shrink to cover cable outer cover and shield for termination. No wire nuts or butt splices are to be used unless previous authorization is given by the engineer. Insulated mechanical connectors shall be manufactured by

Penn-Union, Galvan Industries, Polaris Electrical Connectors, or an approved equal manufacturer.

204.4.1514 Power and control wiring will follow the NFPA 79 Chapter 13 standard.

204.4.15.15 Control wiring labeling shall follow NFPA 79 Chapter 13 standard. Control wiring identification tags shall be a thermal transfer print. A Brady TLS2200 or equivalent.

END OF SECTION

204.5 Painting/Coating

204.5.1 Surface Preparation and Shop Prime Painting: All equipment and disturbed surfaces shall be cleaned and shop primed per equipment manufacturer's recommendation as part of the work. Equipment nameplates and similar information tags shall be masked off for removal after finish coat applications. All surface preparation for applying a specified coating system shall be done in accordance with the appropriate "Application Bulletin" from the manufacture for the specific product specified. Equipment vendors/manufactures shall be consulted concerning the required final coating system to ensure that it will be compatible with the primer coat applied at the factory, in the event that the shop applied primer coat is not removed prior to the coating installation.

In coordination with the painting system submittals, the Contractor shall coordinate and provide an independent testing service or Manufacture's Representative to conduct an overcoat analysis testing report and topcoat compatibility testing prior to finalizing product selection and submission. The written report shall be included in the submittal process for all unique areas of new work and would include sufficient number of testing locations for inspection certification of all areas of the contract new work.

Provide minimum SP-10 Near white blasting unless Manufacture requirements are more stringent in all areas submerged or exposed to raw sewage, grit structures, sewage flow structures, classification spaces (as shown on plan sheets) and sewage process equipment (high corrosive areas).

New and rehabilitation work should include, but not limited to field inspection/investigations/testing, storage, preparations, proper procedures, access coordination, a "complete scope application" and any required details for a finish product.

204.5.2 Final Coat: Unless otherwise specified, all new equipment shall be shop or field painted with a final coat, provided all shop painted finish surfaces shall receive matching field touch-up painting as final treatment, all with a finish coat per the equipment manufacturer's recommendation. All disturbed surfaces shall be field painted after equipment installation with a finish coat per the equipment manufacturer's recommendation.

204.5.2.1 Disturbed surfaces will be defined as including piping between suction and discharge valves on pump assembly replacements and pipe to either side of valves on individual valve replacements. All other disturbed surfaces will be defined as existing materials adjacent to new equipment.

204.5.3 Coating Systems

204.5.3.1 The Coating System for painting structural steel, piping, valves, etc. not exposed to sunlight shall be Sherwin-Williams Coating System Identification A-1, Alkyd 2-coat system. This system has a primer "KemKromik, Univ. Primer" and a finish coat "Industrial Urethane, Alkyd Enamel" or an approved equal. Contractor shall submit supplier information for approval prior to painting.

204.5.3.2 The Coating System for painting structural steel, piping, valves, etc. non-immersed, mildly corrosive, wet environments and not exposed to sunlight shall be Sherwin-Williams Coating System Identification E-1, Polyamide Epoxy system. This system has a primer "Macropoxy 646" and a finish coat "Macropoxy 646" or an approved equal. Contractor shall submit supplier information for approval prior to painting.

204.5.3.3 The Coating System for painting metal surface for exterior weathering exposure in a corrosive environment shall be Sherwin-Williams Coating System Identification EU-2,Urethane Finish, Corrosive Areas 3-coat system or equal. This system has a primer "CorothaneGalvapac", second coat "Macropoxy 646" and a finish coat "Hi-solids Polyurethane" or an approved equal. Contractor shall submit supplier information for approval prior to painting.

204.5.3.4 Coating System for painting metal surface for full or partial immersion service shall be Sherwin-Williams Coating System Identification E-3, Amine Epoxy Glass Flake Reinforcement or equal. This is a two-coat system using Sher-Glass Epoxy FF. The first coat shall have a red oxide color with a minimum dry film

thickness of 10-15 mils. The second coat shall have a haze gray color. Total dry film thickness shall be a minimum 20-25 mils. Application and total dry film thicknesses shall be installed per Manufacture's recommendations.

204.5.3.5 Paint color code shall adhere strictly to DEQ code requirements. Paint Color Schedule (<u>All colors and codes are Sherwin Williams. A crossover for Tnemec and Carboline is available on request</u>.):

a.	Potable	WaterFlyway SW6794
b.	Plant Effluent Water (PEW)	Pantone 522, DEQ
c.	Chilled Water	French Roast SW6069 w/ Heartthrob SW6866 bands
d.	Heating Water Supply	Gray Screen SW7071 w/ White bands
e.	Heating Water Return	Gray Screen SW7071 w/ Black bands
f.	Compressed Air	Supreme Green W6442
g.	Instrument Air	Supreme Green SW6442
h.	Blower Air	Supreme Green SW6442
i.	Natural Gas	Heartthrob SW6866
j.	Sludge Return	Bagel SW6114
k.	Sludge Waste	Sensational Sand SW6094
l.	Digested Sludge	French Roast SW6069
m.	Sludge Sample	Web Gray SW7075 w/ Hearththrob SW6866 bands
n.	Drain/Sump	Web Gray SW7075
o.	Raw Sewage	Software SW7074

204.5.3.6. If the equipment or piping being painted does not fall under any of these categories, the contractor shall make the best color match to the materials being replaced and adjacent like materials after submittal of color selection for acceptance.

204.5.3.7. PEW System specific requirements: All PEW System piping, valves, supports, operators, couplings and miscellaneous shall be color coded and marked as follows.

a. Color Coding: Topcoat shall be Purple (Pantone 522) per the Oklahoma Department of Environmental Quality (DEQ) Title 252, Chapter 656, Section 252:656-27-4. In addition, piping shall have orange bands that are six (6) inches wide and spaced along the pipe at five (5) foot intervals.

b. Lettering: The following language: "CAUTION: RECLAIMED WATER-DO NOT DRINK." shall be provided on the pipe near the equipment served, adjacent to valves, at each branch or tee, and at least every 50 feet in straight runs of pipe and be per Department of Environmental Quality (DEQ) Title 252, Chapter 656, Section 252:656-27-4. Lettering shall be painted or stenciled on piping or shall be applied as snap-on markers. Snap-on markers shall be plastic sleeves, Brady "Bradysnap-On B-915" or Seton "Setmark" Lettering shall be white. Reference Table 1 for lettering size requirements.

c. Flow Arrows: PEW System piping shall not have flow arrows.

204.5.3.8 After painting, any labeling or tags covered by the paint shall be re-applied, updated or uncovered such that all labels are readable and clearly identifies the system. In the event of new piping or equipment replacing piping or equipment with labeling, the new equipment shall be labeled to match the existing. Marking and signage shall be applied once area painting is complete as part of the schedule of value item.

204.5.3.9 Equipment supplied from the manufacturer with an epoxy coating or manufactured from a corrosion resistant material (stainless steel, etc…) shall not be painted/coated after installation.

204.5.3.10 Factory applied epoxy coating systems shall be in the following thicknesses unless noted otherwise per Manufacturer's recommendations:

a.	Primer Coat	*3.0 to 5.0 mils
b.	Finish Coat	*4.0 to 6.0 mils

*Note – Per Manufacturers Recommendations.

204.6 Concrete Coating

204.6.1 Materials: Concrete coating shall be Sikagard 62, Raven 405, Sauereisen SewerGard No. 210, or an approved equal to protect concrete and concrete repairs from H_2S and other corrosive elements found in wastewater process facilities. Epoxy coating to be applied according to the manufacturer's installation instructions and shall extend beyond repair areas by a minimum of 6". All concrete coating products shall be handled and stored in the manner set forth in the manufacturer's installation instructions.

The Contractor shall coordinate and provide an independent testing service or Manufacture's Representative to conduct an overcoat analysis testing report and top coat compatibility testing prior to finalizing product selection and submission. The written report shall be included in the submittal process for areas of new work and would include sufficient number of testing locations for inspection certification of all areas of the contract new work.

204.6.2 Surface Preparation: Concrete surfaces to receive coating shall be inspected prior to surface preparation to determine the condition of the surfaces specified to receive the coating product(s) and the appropriate method or combination of methods to be used for surface preparation to meet the requirements of the coating system(s) to be applied per manufacturer's instructions. The Contactor shall bid the specified product(s) and, if a compatibility issue is found. The Manufacture will provide additional recommendations for the application and environment during the submittal process. Special attention during the Mandatory prebid meeting shall be taken by the Contractor and their

subcontractors to inspect and observe the existing concrete corrosion resistant coating, if any.

204.6.2.1 Oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the coating to the substrate shall be removed per ASTM D-4258.

204.6.2.2 Incidental to this contract, every effort shall be made to minimize voids or holidays, providing a uniform coating thickeness and coating thin areas by this contract to comply with Manufacturers recommended requirements. Concrete fins, protrusions, burrs, sharp edges, surface debris, existing coating(s) and concrete spatter shall be corrected by grinding or scraping on both new and existing concrete surfaces. Contract document plan sheets indicate areas of new concrete and existing concrete coating application areas.

204.6.2.3 Unless otherwise submitted and approved by the Engineer, surfaces to receive coating shall be abrasive blasted per ASTM D-4259 to remove laitance and weak concrete to expose subsurface voids, open honeycomb and air pockets. Concrete substrate shall receive a surface profile matching or exceeding the Manufacturer requirements. Prior to blasting, existing concrete as indicated on the contract plans sheets may require physical abrasive tool or bush hammer preparations over the entire surfaces to provide and prove the stable substrate as part of the new work. After blasting, surfaces shall be cleaned of all loose blast grit, dust and other debris by sweeping, vacuuming, air blasting and washing as necessary.

A fully prepared surface meeting the Manufacturers requirements shall be provided, including but not limited to surface preparations, mechanical rubbing/surfacing or grouted surface ("surfacer/primer") to comply with the Manufacturer substrate is incidental to the new coating system scope. A mortar slurry fully rubbed surface or concrete repairs of the wall is not allowed unless specifically recommended by the Manufacturer and approved by the Engineer as part of the new work. Surfacer or grouting for the Manufacturer's

requirements may include bug holes, chipped small voids, light honeycomb, cleaning edges, form "fins" or other small imperfections in concrete surfaces as required for the new coating system installation. Additionally, preparations may also include preparations of the existing coating systems for the new system. For structural concrete repairs, see plan sheet details and applicable bid items.

204.6.2.4 Surface preparation method(s) used shall be performed in a manner that provides a uniform, sound clean neutralized surface suitable for the specified coating product(s).

204.6.2.5 Infiltration shall be stopped by using a material which is compatible with the repair products and is suitable for top coating with the coating product(s). The Contactor shall bid the specified product(s) and, if a compatibility issue is found. The Manufacture will provide additional recommendations for the application and environment during the submittal process.

204.6.2.6 Where defective concrete is encountered requiring repair at the direction of the Engineer refer to Specification Section 204.7 Concrete Rehabilitation for requirements. Concrete rehabilitation areas are defined by the direction of the Engineer for building back of the concrete to an original finished surface if required, a new finished surface if required or areas defined as concrete rehabilitation as shown on the plan sheets and/or by specific bid item for such concrete or structural repairs. **All other surface preparations required for coatings are incidental to the new coating system.**

204.6.3 Application of coating products: Application procedures shall conform to the recommendations of the coating product(s) manufacturer, including environmental controls, product handling, mixing, application equipment and methods.

204.6.3.1 Prepared surfaces shall be primed by application of the waterborne epoxy primer described herein at an application rate of 200 square feet per gallon (8 mils wet film thickness). The primer shall be allowed to dry to a tack free state. The solvent-free epoxy topcoat

described herein shall then be spray applied to a minimum wet film thickness of 80-100 mils.

204.6.3.2 No more than 12 hours shall be permitted to pass between each application of the waterborne epoxy, the solvent-free epoxy primer and the epoxy topcoat. Subsequent top coating or additional coats of the coating product(s) shall occur within the products recoat window as adjusted for temperature extremes. Additional surface preparation procedures will be required if this recoat window is exceeded.

204.6.3.3 Coating product(s) shall interface with adjoining construction materials throughout the structure to effectively seal and protect concrete substrates from infiltration and attack by corrosive elements. Procedures and materials necessary to affect this interface shall be as recommended by the coating product(s) manufacturer.

204.6.4 Submittals: The Contractor shall submit the following to the Engineer, in accordance with this Specification:

- Product data sheets and installation procedures for proposed concrete repair mortar(s).

- Detailed design notes, calculations and Shop Drawings for any temporary works, including formwork and falsework.

- Draft Daily Coating Report form (or one can be provided by the Owners Representative). Submit the draft Daily Coating Inspection Report "form(s)" with the paint submittal(s) for approval or a form can be provided by the Engineer. Provide a completed copy of a Daily Coating Report documenting the application details, including but not limited to: Manufacture's material product information being applied, project information, application location, date, ambient temperature, surface temperature, humidity, dew point, work hours applied, starting time, ending time and other relevant application information. Submit Daily Coating Inspection Report form signed by the applicator

applying the paint/coating to Owners Representative at the end of each workday's activities. At the end of the project, transmit the completed package of the Daily Coating Inspection Reports as project record documentation to the Owners Representative.

204.7 Concrete Rehabilitation

204.7.1 Description: The Work shall consist of:

- Removing the deteriorated concrete as shown and described on the Drawings and in this Specification, including saw cutting the perimeter of the repair area.
- Preparing the surface of the concrete for the repair, including abrasive cleaning, cleaning of existing reinforcement, and applying bonding agent to prepared reinforcement and concrete surface bonding agent as required by Manufacturers systems. Minimum exposed reinforcement rehabilitation would include sand blasted SSPC-SP 5 white metal blast cleaning and coated with (green) epoxy reinforcement repair coating system unless specifically required otherwise.
- Supplying materials and the mixing and placing of concrete repair mortar or concrete as shown and described on the Drawings and in this Specification including vibrating, finishing and curing.
- Supplying, fabricating, constructing, maintaining and removing temporary works, including falsework and formwork.

204.7.2 Submittals: The Contractor shall submit the following to the Engineer, in accordance with this Specification:

- Product data sheets and installation procedures for proposed concrete repair mortar(s).

- Detailed design notes, calculations and Shop Drawings for any temporary works, including formwork and falsework.

204.7.3 Materials: The Contractor shall supply all materials necessary for the repair and restoration of deteriorated concrete areas as follows:

204.7.3.1 Acceptable Manufacturers:

a. Sika MonoTop 611, as manufactured by Sika Corporation, Lyndhurst, New Jersey, and Quadex QM-1s Restore, as manufactured by Quadex, North Little Rock Arkansas, are considered to conform to the requirements of this specification and has performed satisfactorily for patching or overlaying for a minimum of three years.

   Sauereisen and other Manufacturers may require specific sub-straight and patching requirements specific system(s) pending submittal approval process.

b. Substitutions: The use of other than the specified product will be considered providing the contractor requests its use in writing to the Engineer. This request shall be accompanied by:

   - A certificate of compliance from an approved independent testing laboratory that the proposed substitute product meets or exceeds the specified performance criteria, tested in accordance with the specified test standards; and
   - Documented proof that the proposed substitute product has a three year proven record of performance of patching or overlaying, confirmed by actual field tests and five successful installations that the Engineer can investigate.

   Certification from the manufacturer demonstrating compliance with the ISO 9000 quality standard in the development, manufacture, and sale of the product.

204.7.3.2 Performance Criteria Typical Technical Data

a. Typical Properties of the mixed polymer-modified portland cement mortar:
   - Working Time: approximately 30 minutes

- Finishing Time: 30-60 minutes
- Color: concrete gray

b. Typical Properties of the cured polymer-modified portland cement mortar:
    - Compressive Strength (ASTM C-109)
        - 1 day: 3,000 psi
        - 7 day: 5,500 psi
        - 28 day: 6,500 psi
    - Splitting Tensile Strength (ASTM C-496) at 28 days: 500 psi
    - Flexural Strength (Modulus of Rupture) (ASTM C-78) at 28 days: 720 psi
    - Bond Strength (ASTM C-882 Modified) at 28 days: 2200 psi
    - Chloride ion permeability (AASHTO T-277): < 600 coulombs
    - The silica fume, polymer-modified portland cement mortar shall not produce a vapor barrier.

204.7.3.3 Materials

a. Silica-fume, Polymer-modified portland cement mortar:

- The mortar shall be a silica fume-enhanced, polymer-modified composition containing a blend of selected cements, plasticizing/water-reducing admixtures and shrinkage compensating agents.
- The material shall be non-combustible, either before or after cure.
- The silica fume, polymer-modified portland cement mortar shall be supplied in a factory proportioned unit.
- The silica fume, polymer-modified portland cement mortar must be placeable from 3 inches in depth and extendable in greater depths.

b. To prepare the silica fume, polymer-modified portland cement concrete (for pumping): the factory proportioned unit maybe extended with 34-36 lbs. of a minus 1⁄4 in. clean, well-graded,

saturated surface dry aggregate, having low absorption and high density. Aggregate shall conform to ASTM C-33.

c. Materials for forming, as required for the designated work, shall be approved by the Engineer.

204.7.4 Construction Methods

204.7.4.1 Surface Preparation Prior to any concrete repairs, the Contractor shall remove all dust, dirt, water and debris from the surface of the concrete in a manner that will not result in the material being deposited into the channel or onto the underlying ground surface below. The Contractor shall supply and erect appropriate protection barriers/shrouding or other approved means as required on the bridge deck or piers so as to completely contain all loose or flying debris from the surface removal preparations. The means of containment shall be subject to the approval of the Engineer. No debris shall fall into the channel or onto any underlying roadway or ground surfaces.

204.7.4.2 Concrete Removal All areas of unsound concrete to be repaired will be marked by the Engineer once the Contractor has cleaned the existing surface as per Section 204.6.2 of this Specification. The Contractor shall saw cut the outer perimeter of the repair areas 1" deep or as directed by the Engineer. Feathered edges will not be acceptable. The Contractor shall take care to ensure that the existing reinforcing steel or prestressing strands (if applicable) are not damaged during saw cutting. Any damage caused by the Contractor to any portion of the structure not intended for repair shall be repaired by the Contractor, at the Contractor's expense, to the satisfaction of the Engineer. The Contractor shall remove all areas of unsound concrete by chipping or other approved methods. Only chipping hammers of the 20 lb class or less shall be used, and operated at an angle of 45 degrees or less from the horizontal. The Contractor shall exercise caution and take care not to damage any existing reinforcing steel intended to remain in place.

204.7.4.3 Types of Repairs Concrete repairs will be classified as follows:

a. Type A Partial Depth Concrete Repair – A Type A repair is defined as removal of unsound concrete to a depth not greater than the top of the existing reinforcing steel. The Contractor shall remove all unsound concrete from the areas as determined by the Engineer until a sound concrete substrate is exposed.

b. Type B Partial Depth Concrete Repair – A Type B repair shall be defined as removal of unsound concrete to a depth a minimum of 1" beyond the existing outer mat of reinforcing steel. For substructure, girder or mass concrete repairs the maximum depth shall be 2" beyond the existing outer mat of reinforcing steel or as directed by the Engineer. For slab repairs the maximum depth shall be mid depth of the slab.

204.7.4.4 The Contractor shall supply and place additional reinforcing steel as directed by the Engineer when the existing reinforcing steel has a section loss of 25% or greater. The reinforcing steel shall be of the same type and size as the existing, and spliced with a minimum lap length of 30 bar diameters. Exposed reinforcing steel shall be sandblasted clean and maintained to a near white condition. The Contractor shall roughen all areas of the existing sound concrete substrate to a ¼" amplitude using methods acceptable to the Engineer. All resulting material and by-products from demolition operations shall be collected, loaded, hauled, and disposed of by the Contractor at an approved waste disposal facility. Costs for reinforcing steel shall be considered incidental and included in other portions of the work.

204.7.4.5 Surface Preparation Immediately prior to placing the repair mortar or concrete, the Contractor shall thoroughly clean the existing concrete surfaces and formed repair areas, and apply a low resistivity bonding agent or cement slurry as recommended by the repair mortar manufacturer or as directed by the Engineer.

204.7.4.6 Repair Mortar Placement and Finishing The concrete repair mortar shall be handled, stored, mixed and applied in accordance with the

manufacturer's instructions. Immediately prior to placing the repair mortar, the Contractor shall thoroughly clean the existing concrete surfaces and formed repair areas, and apply a low resistivity bonding agent or cement slurry as recommended by the repair mortar manufacturer or as directed by the Engineer. The Contractor shall place the repair mortar such that the existing profile and cross section are restored to their original dimensions. Any deviations of ¼" or greater from the repaired areas to the existing surface shall be repaired by the Contractor at his expense to the satisfaction of the Engineer. If the existing or repair concrete surface is damaged in any way by construction operations, or if the concrete repair shows signs of distress or scaling prior to final acceptance, it shall be repaired or replaced by the Contractor at his own expense. The Contractor shall finish the repair surface in accordance with the concrete coating manufacturer's requirements.

204.7.4.7 Curing shall be in accordance with the manufacturer's instructions or as otherwise directed by the Engineer.

204.7.5 Quality Management

204.7.5.1 General Concrete repair mortar that is not stored, handled, prepared, placed, or cured in accordance with the manufacturer's instructions will be rejected by the Engineer and his/her decision shall be considered final. The Engineer reserves the right to require immediate removal of any concrete from rejected batches that may have already been placed in the structure. Quality assurance testing will be carried out by the Engineer and all associated costs will be paid for by the Owner. There shall be no charge to the Owner for materials taken by the Engineer for testing purposes.

204.7.6 Method of Measurement

204.7.6.1 Concrete Repairs Concrete repairs will be measured on a surface area basis. The area to be paid for will be the total number of square feet of concrete repaired in accordance with this specification as computed from measurements made by the Engineer.

204.7.7 Basis of Payment

2.4.7.7.1 Type A Partial Depth Concrete Repair – Type A Partial depth concrete repairs will be paid for at the Contract Unit Price per square foot for "Type A Partial Depth Concrete Repair", measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the Work.

204.7.7.2 Type B Partial Depth Concrete Repair – Type B Partial depth concrete repairs will be paid for at the Contract Unit Price per square foot for "Type B Partial Depth Concrete Repair", measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the Work.

END OF SECTION

PART 1 - GENERAL

1.1 STANDARDS

A. Concrete work shall conform to all requirements of ACI 301-89 "Specifications for Structural Concrete for Buildings", ACI 350 "Code Requirements for Environmental Engineering Concrete Structures", ACI 318-89 "Building Code Requirements for Reinforced Concrete" except as modified herein.

B. All referenced standards shall be the latest editions.

C. City of Tulsa and ODOT as required.

1.2 SCOPE

A. Work consists of furnishing all plant, labor, materials, equipment and appliances, and performing all operations in connection with installation of the concrete work, complete, in strict accordance with the Specifications and Drawings.

1.3 INSPECTION

A. Embedded items must be inspected and tests for concrete and other materials shall have been completed and approved by the Engineer before concrete is placed.

1.4 SLAB ON EARTH

A. Before proceeding to construct concrete slabs on earth, all pipes under concrete floor on earth shall have received the required tests. All backfill and fill material under slabs on grade shall be compacted in 6" layers to 95% maximum density as measured by AASHTO T99 test method. Unsuitable material encountered in subgrade shall be removed and replaced with material approved by the Engineer. Subgrade shall be brought to true, even plane and compacted to solid bearing. Gravel drainage fill shall be placed and compacted where shown on Drawings.

PART 2 - MATERIALS

2.1 All concrete materials shall conform to the latest revised ASTM Designations listed below and

shall be subject to the approval of the Engineer:

A. Coarse Aggregate shall be crushed stone conforming to ASTM C-33 with a maximum size of 1".

B. Fine Aggregate shall conform to ASTM C-33 and shall be washed river sand composed of clean, uncoated grains of strong materials.

C. Cement shall be Portland cement conforming to ASTM Specification C-150, Type V. Only one brand of cement shall be used for exposed concrete.

D. Water: Clean, fresh and free from oil, acids, alkali, vegetable, sewage, organic or other deleterious matter.

E. Air-Entraining Admixtures shall conform to ASTM C-260.

G. Premolded Expansion Joint Filler Strips shall be non-extruding type conforming to the current AASHTO Designation M213.

H. Non-Shrink Grout shall be Pre-mixed "Embeco" as manufactured by Master Builder's, "Ferrolith G" as manufactured by Sonneborn-Contech, or approved equal. Type as recommended by the manufacturer for the particular applications.

I. Liquid Curing Compound/Sealer shall be "MC 429" as manufactured by Master Builder's, "Kure-N-Seal" as manufactured by Sonneborn-Contech, "Thompson's Water Seal" as manufactured by E. A. Thompson, Inc. or approved equal.

J. Granular Drainage Fill: Required under all interior building concrete slabs on grade and where noted on the drawings. It shall be either:

1. Clean, washed gravel with particle sizes grading from maximum of 1" down to not more than 5% passing a No. 4 sieve.

2. Clean, washed coarse sand with particular sizes ranging from pea gravel down to largest grains permitted in concrete sand.

K. Joint Waterproofing for existing structures or as required on the plans shall be Ironite

(Metallic) Waterproofing as manufactured by the Ironite Company of Chicago, Illinois or approved equal.

L. Vapor Barrier required under all interior concrete slabs on grade and where noted in drawings shall be polyethylene sheet, 6 mil thickness conforming to ASTM E-154.

M. Liquid Chemical Hardener shall be the magnesium fluosilicate and zinc fluosilicate type "Lapidolith" as manufactured by Sonneborn-Contech, Inc., "Symons Quad Cure" as manufactured by Symons Corp., "Hornolith" as manufactured by W. R. Grace & Co., or approved equal.

N. Cementitious Waterproofing and Finish Compound shall be "Thoroseal Plaster Mix" with "Acryl 60" as manufactured by Standard Dry Wall Products or equal.

2.2 QUALITY AND CONTROL

A. Design

Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate and water. All concrete shall be designed by an independent testing laboratory, approved by the Engineer, in accordance with the A.C.I. Standard "Recommended Practice for Selecting Proportions for Concrete" (ACI 211) to produce the strength for each class of concrete specified, and with slumps and maximum sizes of coarse aggregate in accordance with the requirements outlined below. The concrete shall be so designed that the concrete materials will not segregate and excessive bleeding will not occur. Submit laboratory trial mix designs and test results for each class of concrete to be used to the Engineer for approval before any concrete is placed. Any costs of the testing laboratory for designing concrete mixes shall be borne by the Contractor. Concrete strengths shall be as follows:

Class A Concrete - 4000 psi minimum @ 28 days (Air entrained) - six (6) sacks cement minimum

Class B Concrete - 3000 psi @ 28 days - five (5) sacks cement minimum

Class C Concrete - 2000 psi @ 28 days

Class D Concrete - 3000 psi @ 28 days (3/8" Max. Aggregate Size "Pea Gravel")

MAXIMUM SLUMPS FOR VARIOUS
TYPES OF CONSTRUCTION

Types of Construction	Hand Placed Maximum	High Frequency Vibrator Used - Maximum
Reinforced Foundation, Footings and Base Slabs of Tanks	5"	3"
Slabs, Beams and Reinforced Walls	6"	5"
Building Columns	6"	5"
Pavements, curb and sidewalks	3"	3"

The slump shall not exceed the maximum specified above for the type of construction for which it is to be used. The 28 day compressive strength determined in accordance with current ASTM Specifications C-39 and C-31 and with specimens cured in accordance with C-31 shall not be less than that shown above for the specified class of concrete. No water will be added after the amount specified by the mix design.

B. Production of Concrete

All ready-mix concrete shall be batched, mixed and transported in accordance with "Specifications for Ready-Mixed Concrete (ASTM C-94)". Plant equipment and facilities shall conform to the "Check List for Certification of Ready-Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association. Site mixed concrete shall conform to the requirements of "Specifications for Structural Concrete" (ACI 301). The Contractor may elect to use either ready-mixed or site mixed concrete for this project provided he informs the Engineer of his choice.

D. Failure of Concrete to Meet Strength Requirements: The concrete shall be considered acceptable if, for any one class of concrete, the average of all tests of any five consecutive sets is equal to or greater than the specified strength, provided that no more than one test in ten falls between 90% and 100% of the specified strength. The only cylinders to be used for determination of concrete acceptability will be those laboratory cured and tested at 28 days. When it appears the tests of laboratory-cured cylinders will fail to meet these requirements, the Engineer may require changes in the proportions of

concrete for the remainder of the work in order to meet the strength requirements. In addition, the Engineer may also require additional curing on portions of the concrete already poured.

The Engineer may also require tests in accordance with Methods of Securing, Preparing and Testing Specimen from Hardened Concrete for Compressive and Flexural Strengths (ASTM Specifications C42) when the concrete cylinder tests fail to meet strength requirements. In the event there still is question as to the quality of the concrete in the structure, the Engineer may require load tests for that portion where the questionable concrete has been placed. Such load tests will be made as outlined in American Concrete Institute Building Code, (ACI 318), and shall be at the expense of the Contractor. In-place testing shall be at the expense of the Contractor.

E. Removal of Under Strength Concrete: If the above tests indicate that a particular batch of previously placed concrete is under strength, the Engineer may direct that the under-strength batch be removed and replaced. The removal of the under-strength concrete shall also include the removal of concrete that has obtained the required strength if the Engineer deems this necessary to obtain structural or visible continuity when the concrete is replaced.

The removal, and replacement of any under strength concrete, shall be made at no additional cost to the Owner. This shall include any new formwork required or any reinforcing steel that may be required. The Owner shall not be charged any additional costs for any extra work that is required because of the failure of any concrete to meet the minimum test requirements.

F. Concrete Strengths: The various strengths of concrete shall be installed as follows:

1. Class A, 4000 psi, Air-Entrained shall be used for all liquid containing and non-liquid containing structures, (footings, driveways, slabs, walls, columns and roofs.)

2. Class B, 3000 psi shall be used for sidewalks, curbs and thrust blocking. Thrust blocking is not permitted within wastewater treatment plant facility grounds. All piping in those locations shall be RJ, see piping specifications for additional requirements.

3. Class C, 2000 psi shall be used for all non-structural fill concrete, mud slabs, over excavation concrete and other selective backfill conditions as approved by the Engineer.

4. Class D, 3000 psi pea gravel concrete (maximum aggregate size of 3/8") shall be used for all masonry fill, masonry columns cells, and masonry bond beams.

PART 3 - INSTALLATION

3.1 PREPARATION BEFORE PLACING

A. Water shall be removed from excavations before concrete is deposited. Hardened concrete, wood chips, shavings, and other debris shall be removed from interior of forms and inner surfaces of mixing and conveying equipment. Wood forms shall be oiled or, except in freezing weather, wetted with water in advance of pouring. Reinforcement shall be secured in position, inspected and approved by the Engineer before starting pouring of concrete.

3.2 CONVEYING

A. Concrete shall be conveyed from mixer to forms as rapidly as practicable and by methods, which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. Chutes used shall be such that concrete slides in them and does not flow. Chutes, if permitted, shall have a slope of less than 1 on 2. Where a vertical drop greater than five (5) feet is necessary, placement shall be through elephant trunks or similar devices to prevent segregation. Ready-mixed concrete shall be delivered with a load ticket showing mix proportions and the time mixing began for each load. The load ticket shall be furnished to the Engineer.

3.3 PLACING

A. Concrete shall be placed before initial set has occurred and in no event after it has contained its water content for more than 30 minutes for site mixed concrete or 1 hour for ready-mixed concrete. Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces free from running water, or upon properly consolidated fills, but never upon soft mud or dry, porous earth. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened

sufficiently to cause the formation of seams or planes of weakness within the section.

B. If a section cannot be placed continuously, provide construction joints as herein specified. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures as to prevent segregation of the coarse aggregate. Construction of forms for the lifts of vertical walls shall be such as to make all parts of the walls easily accessible for the placement, spading, and consolidation of the concrete as specified herein.

C. No "finished water" shall be surface applied during finishing efforts.

D. Curing methods shall be submitted to the Engineer and applied per manufacture's recommendations.

3.4 VIBRATION

A. All concrete shall be placed with the aid of mechanical vibration equipment as approved by the Engineer. Vibration shall be transmitted directly to the concrete; in no case shall it be transmitted through forms. The duration of vibration at any location in the forms shall be held to the minimum necessary to produce thorough compaction. Vibrations shall be supplemented by forking or spading by hand, and adjacent to the forms on exposed faces in order to secure smooth, dense and even surfaces, with particular care being taken to prevent coarse aggregate from becoming set too near any surfaces that are to receive rubbed finish.

3.5 CONSTRUCTION JOINTS

A. Construction joints shall be formed as indicated on the drawings or as approved or directed by the Engineer. Contractor shall submit a joint location plan for each structure to the Engineer for approval 28 days prior to commencing concrete operations on that structure. Where indicated or required, dowel rods shall be used. All concrete at the joints shall have been in place not less than 12 hours, and longer if so directed by the Engineer, before concrete resting thereon is placed. Before placing is resumed, or commenced, excess water and laitance shall be removed, and concrete shall be cut away, where necessary, to insure a strong dense concrete at the joint. In order to secure adequate bond, the surface of concrete already in place shall be cleaned, roughened, and then spread with a one-half (½) inch layer of mortar of the same cement-sand ratio

as is used in the concrete, immediately before the new concrete is deposited. The unit of operation is not to exceed 40 feet in any horizontal direction, unless otherwise required by the Drawings. Construction joints, if required, shall be located near the mid-point spans for slabs, beams or girders. Joints in columns or piers shall be made at the underside of the deepest beam or girder at least five (5) hours before any overhead work is placed thereon. Joints not shown or specified shall be so located as to least impair strength and appearance of work. Vertical joints in wall footings shall be reduced to a minimum. Placement of concrete shall be at such a rate that surfaces of concrete not carried to joint levels will not have attained initial set before additional concrete is placed thereon.

B. Girders, beams and slabs shall be placed in one operation. To ensure a level straight joint in exposed vertical surfaces, a strip of dressed lumber may be tacked to the inside of the forms at the construction joint. The concrete shall be poured to a point one (1) inch above the underside of the strip. The strip shall be removed one (1) hour after concrete has been placed and any irregularities in the joint line leveled off with a wood float and all laitance removed. Waterstops shall be installed in all construction joints below grade or in liquid containing structures as noted on the Plans. Install as per SECTION 3.3, CONSTRUCTION JOINTS, EXPANSION JOINTS, & WATERSTOPS.

3.6 PATCHING

A. Any concrete which is not formed as shown on the Plans, or for any reason is out of alignment or level or shows a defective surface shall be considered as not conforming with the intent of these Specifications and shall be removed from job by Contractor at his expense, unless the Engineer grants permission to patch defective area, which shall be done in accordance with the following procedure. Permission to patch any such area shall not be considered a waiver of the Engineer's right to require complete removal of defective work if patching does not, in his opinion, satisfactorily restore quality and appearance of surface. Suitable non-shrink, latex or epoxy mortar shall be used for patching and repairing defective surface if permitted by the Engineer.

B. After removing forms, all concrete surfaces shall be inspected and any poor joints, voids, stone pockets, all tie holes, or other defective areas shall be patched, if permitted by the Engineer. Where necessary, defective areas shall be chipped away to a depth of not less than one (1) inch with edges perpendicular to the surface. Area to be patched and a space at least six (6) inches wide entirely surrounding it shall be wetted to prevent

absorption of water from the patching mortar. A grout of equal parts Portland cement and sand, with sufficient water to produce a brushing consistency, shall then be well brushed into the surface followed immediately by the patching mortar. The patch shall be made of the same material and of approximately the same proportions and shall not be richer than 1 part cement to 3 parts sand. White Portland cement shall be substituted for a part of the gray Portland cement to match color of the surrounding concrete. The proportion of white and gray cements shall be determined by making a trail patch. The amount of mixing water shall be as little as consistent with the requirements of handling and placing. The mortar shall be retempered without the addition of water by allowing it to stand for a period of one (1) hour during which time it shall be mixed occasionally with a trowel to prevent setting.

C. The mortar shall be thoroughly compacted into place and screened off so as to leave patch slightly higher than surrounding surface. It shall then be left undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. The patch shall be finished in such a manner as to match the adjoining surface. On surfaces where unlined forms have been used, the final finish shall be obtained by striking off the surface with a straightedge spanning the patch and held parallel to the direction of the form marks.

D. Tie holes left by withdrawal of rods or the holes left by removal of ends of ties shall be filled solid with non-shrink grout after first being thoroughly wetted within 7 days of placement and prior to any area backfill.

3.7 SLAB FINISHES

A. Exterior Concrete Walks:

After thoroughly consolidating the concrete the top surface shall be struck off with a straight edge and tamped or vibrated sufficiently to bring mortar to the surface. Finish with a wood float to a smooth, even surface and lightly broomed to provide "slip resistant" surface. Edges shall be rounded with a 1/4" radius.

B. Interior slabs to receive grout fill or mortar setting bed shall be finished by tamping concrete with special tools to force coarse aggregate below the surface, and screened with straightedges to bring surface to finish plane with a tolerance not exceeding 1/8" in 2 feet. Surface shall be left roughened sufficiently to produce good bond with topping

material. Use stiff brushes, brooms or rakes as necessary to provide 1/8 inch deep grooves at maximum of ½ inch on center.

C. Top and bottom slabs of all structures and water carrying conduits except as noted otherwise on the Plans shall be finished as follows: The top of the slab shall be screened to grade and cross section; lightly tamped as required to bring up a good bed of mortar for finishing and re-screened as necessary. The surface shall then be finished with a wood float and leveling darby. No further finish will be required on top slabs of structures or conduits, which are to be buried. In the case of all exposed top slabs of structures and conduits, they shall be given a final wood float and a lightly broomed, slip resistant finish to a uniform surface, which conforms with accuracy to required shape, slope and grade. Slabs shall be edged as appropriate. No liquid hardener is to be applied to these surfaces.

D. Interior floor slabs that are not to receive any finish floor covering shall be "slip resistant finish" as follows: The top surface shall be steel troweled and have a final finish applied by brushing lightly with a soft bristle brush to form a slightly roughened surface.

E. Liquid Hardener shall be applied to the floors where scheduled to be exposed concrete. Concrete surfaces to be treated must be thoroughly set and dry, clean and free of dust. Three applications of the liquid hardener are required, using one gallon per 100 square feet for the complete treatment. Apply hardener strictly according to the manufacturer's printed instructions. Liquid floor hardener is not required when a minimum of two (2) coats of Thompson's Waterseal or equal has been used as a curing and/or separating compound. Submit material and method to be used for Engineer's approval.

3.8 FINISH OTHER THAN SLABS

A. All top surfaces, other than slabs, not covered by forms, and which are not to be covered by additional concrete or fill shall receive a wood float finish without additional mortar. Care shall be taken that no excess water is present when the finish is made. Other surfaces shall be brought to finished elevations and left true and regular. All exposed top surface interior concrete shall be grouted smooth and given a cement wash of one part light colored Portland cement and two parts fine aggregate mixed with water to consistency of thick paint. Grout shall be cork or wood floated to fill all pits, air bubbles, and surface holes. Excess grout shall be scraped off with a trowel and rubbed with burlap to remove any visible grout film. Surface shall be kept damp during setting period.

The finish for any area shall be completed in the same day and the limits of a finished area shall be made at natural breaks in finished surface. Painting of exposed-to-view concrete surfaces is specified under SECTION 9.1 - PAINTING of these Specifications.

B. Rubbed Finish:

Unless otherwise indicated, all faces (except top surfaces of slabs) exposed to view, such as walls, grade beams, columns, beams, walls of water carrying conduits to a point 1'-0" below normal water level, canopy soffits and fascias, etc. shall be finished as follows:

Forms shall be removed, as specified in SECTION - CONCRETE FORMWORK, and all fins removed, off-sets leveled, damaged places and depressions resulting from the removal of metal ties or other causes shall be carefully pointed with a mortar of sand and cement in the proportion which has been employed for the particular class of concrete treated. The surface film of all such pointed places shall be carefully removed before setting occurs. After the point has set sufficiently to permit it, all exposed surfaces shall be dampened and rubbed with a No. 16 Carborundum stone, to a smooth even plane. Final rubbing shall be done with a No. 30 Carborundum stone, or an abrasive of equal quality, to obtain an entire surface of a smooth texture and uniformity in color. Mortar or grout worked up during rubbing shall be promptly removed by sacking with burlap or other suitable means so that no visible grout film or paste will remain. A cement wash or plaster coat shall not be used. All surfaces shall be finished uniformly smooth and washed clean. The rubbed finish for any area shall be completed in the same day and the limits of a finished area shall be made at natural breaks in the finished surface. If the Contractor does not provide suitable surface finish using Carborundum stones specified above, the Engineer, without additional cost to the Owner, may require the use of a power operated grinding machine or other methods to produce the desired finish.

C. Cementitious Waterproofing and Finish:

As an option to the rubbed finish, as specified herein, all faces (except top surfaces of slab) exposed to view, such as walls, grade beams, columns, beams, canopy soffits and facias, etc., shall be finished using "Thoroseal" coating or approved equal as described in the following paragraphs.

1. General

Forms shall be removed, as specified in SECTION 3.4 - CONCRETE FORMWORK, and all fins removed, off-sets leveled, damaged places and depressions resulting from the removal of metal ties or other causes shall be carefully pointed with a mortar of sand and cement in proportion which has been employed for the particular class of concrete treated. The surface film of all such pointed places shall be carefully removed before setting occurs. After the point has set sufficiently to permit it, all exposed surfaces shall receive the following treatment.

2. Mixing

Thoroseal plaster mix shall be prepared using a solution composed of not less than one part Acryl 60 (approximately two quarts Acryl 60 per bag) and three parts of clean, potable water (for ceilings, use 1 part Acryl 60 to 2-1/2 parts of the water). This solution shall then be added to the Thoroseal plaster mix slowly in sufficient quantity so that the mixture is the consistency of a heavy batter suitable for application by method specified. Color to be selected by the Owner.

3. Application

At Contractor's option, one of the following methods of application shall be selected:

a. Sprayed-on finish should be applied with plaster-type spray gun, not high pressure paint type. Spray on evenly distributed coat of Thoroseal plaster mix. To spot-fill deep holes, float or brush first coat before starting second spray application.

Thoroseal plaster mix shall be applied on average surfaces in two coats at the rate of 5 to 6 lbs. per square yard for concrete walls, 6 to 9 lbs. per square yard for masonry walls; but sufficient material shall be applied to fill all holes and voids.

b. Trowel and float finish - Apply light trowel coat of Thoroseal plaster mix over entire surface to be treated. The workman shall make sure the material is firmly pressed into all voids and leveled. Allow this coat to cure thoroughly before applying the regular trowel application. When

surface is set so it will not roll or lift, float uniformly using a sponge float.

Thoroseal plaster mix shall be applied on average surfaces at the rate of 4 to 6 lbs. per square yard for concrete walls, 6 to 9 lbs. for masonry walls. If concrete is rough or untrue, 6 to 9 lbs. per square yard may be required, but sufficient material shall be applied to fill and seal all pores and voids. This application will be approximately 1/8" thick. Leveling uneven surfaces will require more material per square yard.

To prevent shadowing of struck or deep masonry joints, or areas of unequal absorption (like some form marks), after key coat has cured for 5 days, apply a light trowel coat of Thoroseal plaster mix with Acryl 60 in the mixing water over the entire surface to be treated. Allow this coat to set thoroughly before applying the regular trowel application as outlined above.

Do not apply when temperatures are 40ºF or due to fall below 40ºF within 24 hours or to frozen or frost-filled surfaces.

3.9 CURING

A. General - Immediately following placing, all Class A and Class B concrete shall be protected from premature drying, hot and cold temperatures, rain, flowing water and mechanical injury. Maintain above 50ºF and in moist condition for at least seven (7) days after placing for normal concrete and three (3) days for high early strength concrete. Comply with "Recommended Practice for Curing Concrete" ACI 308, unless otherwise indicated. Curing compound of satisfactory composition and characteristics may be used except on surfaces to which new concrete is to be bonded or surfaces scheduled to be painted or to receive other coating and provided such compound does not stain or discolor any surface which will be exposed. Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

B. Cold Weather Procedures - Protect concrete work from physical damage or reduced

strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306, "Cold Weather Concreting", and as herein specified.

1. When air temperature has fallen to or is expected to fall below 40ºF, uniformly heat water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55ºF, and not more than 80ºF at point of placement.

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

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

4. Contractor shall obtain and keep on the Project site a copy of the current edition of ACI 306, "Recommended Practice for Cold Weather Concreting", for reference during all concrete operations in cold weather.

C. Hot Weather Procedures:

When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305, "Hot Weather Concreting", and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90ºF. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Wet forms thoroughly before placing concrete.

4. Do not use retarding admixtures unless otherwise accepted in mix designs.

5. Contractor shall obtain and keep on the project site a copy of ACI 305R, "Hot Weather Concreting" for reference during all concreting operations in hot weather.

D. Protection from the Sun:

All concrete shall be adequately protected from injurious action of sun in a manner satisfactory to the Engineer.

E. Temperature Control:

During and at the conclusion of the specified curing period, means shall be provided to ensure that the temperature of the air immediately adjacent to the concrete does not fall more than 3ºF in any 1 hour nor more than 30ºF in any 24 hours.

3.10 NON-SHRINKING GROUT

A. Where non-shrinking grout is called for on the Plan, it shall be mixed in strict accordance with the manufacturer's directions. It shall be of a type as recommended by the manufacturer for the particular application.

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE

A. The extent of concrete reinforcement is shown on the drawings and in schedules.

B. The work includes fabrication and placement of reinforcement for cast-in-place concrete, including bars, welded wire fabric, ties and supports.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

Comply with requirements of the latest edition of the following codes and standards, except as herein modified:

American Welding Society (AWS), AWS D1.4 "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction".

Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice". (Current Ed.)

American Concrete Institute (ACI), ACI 318 "Building Code Requirements for Reinforced Concrete".

American Concrete Institute (ACI), ACI 350 "Code Requirements for Environmental Engineering Concrete Structures

B. Submittals:

Mill Certificates; Concrete Reinforcement: Submit steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

Shop Drawings: Reinforcing number, sizes, spacing dimensions, configurations, locations, mark numbers, lap splice lengths, concrete cover and reinforcing supports. Sufficient reinforcing details to permit installation of reinforcing without reference to contract drawings.

1.3 DELIVERY, HANDLING AND STORAGE

A. Deliver reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

1.4 MATERIALS

A. Steel reinforcement shall conform to the "Specification for Deformed Billet Steel Bars for Concrete Reinforcement," ASTM A615, Grade 60.

B. Wire fabric reinforcement shall conform to the current "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement," ASTM A-185, or "Specifications for Welded Deformed Steel Wire Fabric for Concrete Reinforcement," ASTM A-497.

C. Supports for Reinforcement shall be bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place. Use only wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.

1.5 SPLICES

A. No splices of bars, except when shown on the Plans, will be permitted without the approval of the Engineer. Minimum lap splice shall be 48 bar diameters unless specifically detailed or noted otherwise on drawings. Splices in adjacent bars shall be staggered a minimum distance equal to the lap splice length. Bars shall be rigidly clamped or wired at all splices in a manner approved by the Engineer. Welding may not be used except with the specific approval of the Engineer. Welding, when approved, shall conform to the AWS D1.4. Welded wire fabric shall be lap spliced a minimum of 2 inches plus the wire spacing at edge laps and end laps.

1.6 DETAILING & FABRICATION

A. Furnish Shop Detail and Field Placing Drawings for all reinforcing steel for approval of the Engineer. Shop Drawings shall include reinforcing, placing plans and details indicating size, location, arrangement, splice locations, bending diagrams, placing sequence, etc. Placing Drawings shall be in sufficient detail to allow field personnel to accurately place reinforcing. Shop and Placing Drawings shall be prepared in accordance with "Manual of Standard Practice for Detailing Reinforced Concrete Structures" ACI 315, current edition. Photographic copies of engineering drawings shall not be used as placing drawings.

B. Reinforcement bars shall be bent cold to the shapes indicated on the Plans. Fabrication tolerances, fabrication, and detailing of steel reinforcement shall conform to the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI-315).

C. Steel reinforcement shall be of the type and size, cut to lengths and bent to shapes as indicated on the Plans. Unless otherwise indicated, hooks, lap splices, embedment lengths, and other details of reinforcement shall be provided as set forth in the ACI Building Code (ACI 318) to develop the full tensile strength of the bar.

1.7 PLACING REINFORCEMENT

A. All reinforcement at the time concrete is placed shall be free from mud, oil, paint, excessive rust and excessive mill scale or any other coating that would destroy or reduce its bond with the concrete.

B. All reinforcement shall be secured in place true to lines and grades indicated by use of metal or concrete supports, spacers, or ties as approved by the Engineer. The bars and mesh shall be tightly secured against displacement by ties of annealed wire, or suitable clips at intersections. Wall reinforcement shall be supported and held securely against displacement in its proper position clear of the forms as indicated on the Plans. Placing tolerance shall conform to ACI 318.

C. Nails shall not be driven into the wall forms to support reinforcement nor shall any other device used for this purpose come in contact with the form on the liquid side of any liquid containing structure. Metal devices used to provide the required clear distances from reinforcing steel to liquid side of concrete surfaces shall be galvanized, or shall be as approved by the Engineer.

D. The main reinforcement of slabs in contact with the ground shall be supported in its proper position, as indicated on the Plans, by means of precast cement mortar blocks, of approved dimensions, resting on the slabs' subbase. Such precast blocks shall be made of mortar composed of 1 part cement to 2 parts sand and shall have a loop of No. 16 black annealed wire cast into each block. The length of the wire loop shall be sufficient to allow the block to be tied to the reinforcement. Blocks shall be spaced at the intervals required to maintain the reinforcement in its required position in the slab during the placing of the concrete. The slab reinforcement shall not be used to support planking or runways used in placing concrete.

E. Bending of bars embedded in hardened concrete will not be permitted except when specifically approved by the Engineer for the field condition encountered. Field cutting of bars will only be permitted when specifically approved by the Engineer.

F. In the case of exposed finish surfaces of floor slabs, galleries, deck slabs, and beams, metal chairs, spacers and other metal accessories necessary to provide the required clear distances and proper alignment and spacing between bars shall be galvanized or shall have plastic protective covering over portions in contact with forms.

1.8 CONCRETE PROTECTION FOR REINFORCEMENT

A. Steel reinforcement shall be placed and held in position so that the concrete cover, as measured from the surface of the bar shall be the following, except as otherwise shown, on the drawings:

1. Slabs:

1½ inches, in general, top and bottom.
1½ inches at surfaces troweled as floor finish, walkway, or driveway.
2 inches on bottom for slabs over water and where exposed to the weather.

2. Footings:

2 inches at top of footings.
3 inches at bottom, sides, and end of footings.

3. Walls:

   2 inches on surfaces against earth.
   1½ inches on interior surfaces.
   2 inches on interior surfaces contacting water.

4. Beams and Girders in Contact with Water:

   2 inch minimum to stirrup steel.
   2½ inch minimum to main longitudinal steel.

5. Columns:

   2 inches, in general, to main vertical reinforcement.
   2½ inches, to main reinforcement on surfaces in contact with water.

6. Beams and Girders: General:

   1½ inch minimum to stirrup steel.
   2 inches minimum to longitudinal steel.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construction joints, expansion joints, and the placing of waterstops where such are indicated on the plans.

B. Construction joints shall be of the type indicated on the drawings and shall be located as shown on the plans unless otherwise approved by the Engineer. Contractor shall submit a joint location plan as specified in 204.8 CAST IN PLACE CONCRETE.

1.2 WATERSTOPS

A. Waterstops shall be installed in construction joints as required by the Plans. All waterstops shall be continuous throughout their length.

B. The waterstops shall be heavy duty polyvinyl waterstop conforming to Corps of Engineers Specification CRD-C-572, latest edition, as manufactured by Serviced Products Division of W.R. Grace and Company: Vinylstops by Sonneborn- Contech; Sealtight Duo-PVC Waterstops by W. R. Meadows, Inc.; Vinylex Corporation; "labyrinth" waterstop, Type B-2 as manufactured by Water Seals, Inc.; or an approved equal of the same type and material and approximately equal in dimensions and weight but not necessarily of exactly the same shape. Waterstops shall be of the size and type designated on the Plans.

C. "Rib Type" waterstops shall be of ribbed construction with a center bulb, 5" wide, capable of resisting a maximum pressure load of 65 feet of water.

D. All waterstops shall be installed so that one-half its width will be embedded on one side of the joint and one-half on the other. The Contractor shall employ a method of holding the waterstop in position for the first pour that is satisfactory to the Engineer. The method selected must ensure that the waterstop will be held securely in true vertical or horizontal position and in straight alignment in the joint.

E. Care shall be exercised to ensure that the waterstop is completely encompassed in good mortar.

F. Preformed Plastic Waterstops:

Preformed Plastic Waterstop, when approved by the Engineer, shall meet or exceed all requirements of Federal Specifications SS-S-00210, "Sealing Compound, Preformed Plastic for Expansion Joints", Type I or Type II. Such plastic waterstop shall be equal to SYNKO-FLEX as manufactured by Synko-Flex Products Company, Houston, Texas, or "CenSeal GS-231" by Concrete Sealants, Inc., New Carlisle, Ohio and shall meet the following requirements:

The plastic waterstop shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, and shall contain no solvents, irritating fumes or obnoxious odors. The plastic waterstop shall not depend on oxidizing, evaporating or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded form of suitable cross-section and of a size to seal the joint areas of concrete sections. The plastic waterstop shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half, to facilitate application of the sealing compound.

1.3 JOINTS IN WATERSTOPS

A. All waterstops shall be continuous and so joined at all points of contact in the same plane, or at intersections with waterstops in different planes, as to form a complete barrier to the passage of water through any construction or contraction joint.

B. Joints in the waterstops, whether made for the purpose of continuity in a straight strip or for the purpose of securing a watertight junction between strips in different planes, shall be made by heat welding as hereinafter specified.

C. Joints in PVC waterstops shall be made by heating the two surfaces to be jointed until the material has softened to the point where it is just short of being fluid and then bringing the two softened surfaces together with a slight rubbing motion followed by firmly pressing them together so that a solid and tight bond is made.

D. The joints in strips of waterstop made in the above manner shall be such that the entire cross section of the joint shall be dense, homogeneous and free of all porosity. All finished joints shall have a tensile strength of not less than 75 percent of the material of the strip as extruded.

E. The heating of the surfaces to be joined shall be done by means of an electric splicing iron designed for the specified purpose and controlled by means of a voltage regulator.

F. In use, the heat of the hot plate shall be so regulated as to prevent too rapid melting and accompanying charring of the waterstop material.

G. The use of makeshift hot plates will not be permitted nor will other means of heating the strips to be joined be allowed except in a case of emergency, as determined by the Engineer.

H. The Contractor shall provide such jigs as will assist in making the joints in a proper and workmanlike manner and in holding the strips so that the alignment of jointed strips is correct and angles are true to those required.

I. Prior to embedment all joints in the waterstop strips will be inspected by the Engineer and any found defective shall be remedied without delay.

1.4 PROTECTION OF WATERSTOP BETWEEN POURS

A. The Contractor shall take such steps as are necessary to protect exposed waterstops in the interim period between concrete pours. This would include damage from construction equipment, tools and concrete "slobbers". In the event the waterstop receives small amounts of construction debris and/or concrete "slobbers" while concrete is "green", the Contractor shall fully clean waterstop directly following the stripping of formwork and prior to the placement of future reinforcement.

1.5 EXPANSION JOINTS

A. Expansion joints of the size and type shown on the plans, or specified herein, shall be placed in concrete pavement or structure as shown on the plans.

1. Materials:

a. Preformed Asphalt Fiber Joint Material

Asphalt fiber sheet filler shall consist of preformed strips of inert material impregnated with asphalt. It shall be of the thickness shown on the Plans or indicated in these Specifications.

The sheet filler shall conform to the requirements of AASHTO Specification M-213 with the following additional provisions.

The sheet filler shall be of such character that it will not be deformed by ordinary handling during hot weather nor become hard and brittle in cold weather. It shall be of a tough, resilient, durable material not affected by weathering.

b. Hot Poured Rubberized Tar Joint Sealer

Hot poured rubberized mastic joint sealer shall consist of a mixture of durable, elastic rubber, coal tar pitch and other materials which will form a resilient and adhesive compound capable of effectively sealing concrete joint surfaces against repeated expansion and contraction. The material shall be installed in accordance with the manufacturer's directions. Hot poured tar sealer shall be used for pavement and sidewalk expansion joints.

B. Joint Surface Preparation:

1. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.

2. For all sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent

or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with Paragraph 4.3.9 of FS TT-S-00227, has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

3. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with diluted ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

C. Installation:

1. Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

2. Prime or seal joint surfaces where shown or recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

4. Install sealants to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead.

5. For sidewalks, pavements and similar joints sealed with elastomeric sealants and

subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, and neither more than 5/8" deep nor less than 3/8" deep.

6. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than ½" deep nor less than 1/4" deep.

7. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either primer/sealer or the sealant.

8. Remove excess and spillage of compounds promptly as the work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.

9. Placement of expansion joint material shall fully cover joint area(s) between concrete placements. No gaps or joint material opens which permit fresh concrete to flow to existing concrete surface will be allowed.

D. Cure and Protection

1. Cure sealants in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner which would significantly alter material's modules of elasticity or other characteristics.

2. Installer shall advise Contractor of procedures required for curing and protection of sealants during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Work in this section includes all labor, plant and material necessary to furnish and install all concrete formwork required by the project. Concrete formwork shall conform to all requirements of current editions of ACI 301 "Specifications for Structural Concrete for Buildings" and ACI 318 "Building Code Requirements for Reinforced Concrete" and ACI 347 "Recommended Practice for Concrete Formwork" and ACI 350 "Code Requirements for Environmental Engineering Structures" except as modified herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms shall be of wood, metal, highly water resistant plywood, or other material approved by the Engineer. Forms for sections greater than 18" thick shall be of wood. Form surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed surfaces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will not be less than two (2) inches from any concrete surface. Wire ties will not be permitted where concrete surface will be exposed to weathering, and discoloration would be objectionable. Exposed concrete shall have approved form liners of Masonite or plywood, or shall be constructed of smooth surfaced plywood.

B. Corner forms forming 3/4 inch chamfers or as otherwise specified on plans, shall be used on all outside corners that are to be exposed in the finished structure. Chamfer forms shall be of molded plastic or polyvinyl chloride chamfer strips. Use one style of form throughout the project. The type to be used shall be submitted to the Engineer for approval.

C. Rustication and Score Line Strips shall be a non-absorbent material such as extruded polyvinyl chloride, plastic, fiberglass or metal or they may be milled from a good quality lumber and well sealed to prevent moisture absorption, wood strips may not have protruding splinters which may become embedded in the concrete. Sealing wood shall be accomplished by emersion or brushing on two coats of form coating.

D. Form Ties for concrete shall have an approved waterstop barrier to prevent seepage of moisture along the ties. The ends of the metal after breaking off shall be minimum of 2 inches from the finished wall face. Submit samples to the Engineer for review. All temporary tie components of tie system shall be removed from placement once placement is completed and prior to backfilling. Non-shrink grout shall be placed at all voids created by ties.

E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

F. Cylindrical Columns and Supports: Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

G. Inserts: Provide metal inserts, anchor bolts and other embedded items for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work.

H. Provide sheet metal reglets formed of the same type and gauge as the flashing metal to be built into the reglets, unless otherwise indicated. Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gauge galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

I. Side forms of footings may be omitted and concrete placed directly against excavation only when requested by Contractor and accepted by Engineer. When forms are omitted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as indicated to provide minimum concrete coverage for reinforcement. Contractor shall maintain the earth form to proper alignment with no sloughing of material into the minimum design profile shown on the drawings.

J. Dovetail Anchor Slots at surfaces to receive masonry veneer to be Heckman #100 or equal.

K. Formwork used for exposed finished concrete surface placements shall be in like new condition and designed to provide flat and true surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design and engineering of formwork, shoring and reshoring as well as its construction is the responsibility of the contractor. Design formwork for loads, lateral pressures and allowable stresses outlined in ACI 347R and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local Building Code. Where conflicts occur between these two standards, the more stringent requirements shall govern.

B. Forms shall be built true to line and grade, and be mortartight and sufficiently rigid to prevent displacement or sagging between supports. All formwork and shoring shall be designed for the construction loads to be placed on them, and the design and construction of said forms shall be in accordance with ACI Standard "Recommended Practice for Concrete Formwork" (ACI 347). The structural adequacy of the formwork shall rest with the Contractor. All forms shall be so constructed that they can be removed without hammering or prying against the concrete.

C. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

D. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

E. Provide temporary openings in wall forms, columns forms and at other locations necessary to permit inspection and clean-out.

3.2 EMBEDDED ITEMS

A. Before placing concrete, care shall be taken to determine that any embedded metal or wood parts are firmly and securely fastened in their correct location as indicated. Use setting drawings, diagrams, instruction and directions provided by suppliers of items

attached thereto. They shall be thoroughly clean and free from coating, rust, scale, oil, or any foreign matter. Embedding of wood in concrete shall be avoided whenever possible, metal being used instead. If wood is allowed, it shall be thoroughly wetted before concrete is placed.

B. All aluminum embedded items shall be coated with epoxy paint where in contact with concrete.

3.3 FORM REMOVAL

A. Forms shall not be removed without approval of the Engineer. Forms shall not be removed before the minimum times given below, or longer if job control tests indicate the concrete has not attained strength specified below, except when specifically authorized by the Engineer.

Beams and Slabs	14 days or proof of strength requirements met.
Walls up to 12" Thick and Vertical Surfaces	1 day if minimum daily temperature is above 50°F, 3 days otherwise
Columns	5 days or proof of strength requirements met.
Walls greater than 12" Thick	3 days if minimum daily temperature is above 50°F with proof of strength requirements met, 7 days otherwise.

B. In general, forms or shores for supported slabs and beams shall not be removed until the concrete, so supported, has acquired 70% of its design strength; except where loads other than the dead weight of the concrete are added, the shores shall not be removed until 24 hours after the concrete has obtained 90% of its design strength. Forms shall be removed immediately after expiration of the lapsed times specified above or sooner, if required by the Engineer, where concrete is to receive a rubbed finish.

END OF SECTION

A. SCOPE

This section covers the furnishing and installation of all miscellaneous metals, including stainless steel, cast iron, and aluminum items not covered in other sections of the Specifications. Work generally included but is not limited to ladders, gratings, handrails and railings, anchorage devices, metal fabrications, and metal stairs.

B. GENERAL

Furnish all miscellaneous items such as anchor bolts, tie down bolts, nuts and washers, supports, connections, expansion and toggle bolts, etc., required by the work. Supplementary parts necessary to complete each item, though such work is not definitely shown or specified, shall be included. Furnish to appropriate trades all anchors, sockets or fastenings required for securing metal work to other constructions and wood items to concrete. Details and specifications of items for which standard products are available are representative guides of requirements for such items. Standard products generally meeting such requirements, will be accepted. Welding shall be continuous along entire area of contact, except where tack welding is permitted. Tack welding will not be permitted on exposed surfaces. All exposed welds shall be ground smooth. Riveting, where exposed, shall be flush type.

C. QUALITY ASSURANCE

Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting wherever taking field measurements before fabrication might delay work.

Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

D. SUBMITTALS

Submit for Engineer's review, 4 sets of shop drawings for fabrication and erection of miscellaneous metal items. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others. Submit duplicate samples of all prefinished or shop finished items for approval of finishes. See specification section 1.3 for additional requirements.

E. MATERIALS AND COMPONENTS

1. Metal Surface, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

2. Ferrous Metals: Except as otherwise specified herein or noted on the Plans, stainless steel and wrought metals shall meet the requirements of the following standards (current edition):

   Gray Iron Castings: ASTM A 48, Class 30.

   Malleable Iron Castings: ASTM A 47, grade as selected.

   Stainless Steel Plates, Shapes, Bars, Tubes shall be AISI Type 304 (18-8) mill finish.

Stainless Steel Castings shall be AISI Type 304 conforming to ASTM A 296, Iron-Chromium-Nickel Alloy.

3. Non-Ferrous Metals:

Aluminum Bar Grating: ASTM B 221, Alloy 6061 or 6063-T6 for bearing bars; ASTM B 221 or B 210 for cross bars or bent connecting bars.

Aluminum Extrusions: ASTM B 221; alloy 6063-T5, except alloy 6005-T5 for pipe; unless otherwise indicated.

Clear anodized finish AA-M21C11A41, unless otherwise indicated.

Aluminum Sheet or Plate: ASTM B 209; alloy 6061-T4; unless otherwise indicated. Mill finish.

4. Fasteners:

General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Provide AISI Type 303, stainless steel fasteners where exposed to liquids of treatment process, for connecting aluminum or where noted to be stainless steel. Select fasteners for the type, grade and class required.

Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

Machine Screws: Cadmium plated steel, FS FF-S-92.

Plain Washers: Round, carbon steel, FS FF-W-92.

Concrete & Masonry Anchorage Devices: Expansion shields, FS FF-S325, Galvanized or Stainless Steel. Wedge type expansion anchors take "Kwik-Bolt" by HILTI Tulsa, Oklahoma or equal, size as noted on the Drawings. Length shall provide minimum embedment in concrete as specified by manufacturer's literature.

Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

Lock Washers: Helical spring type carbon steel, FS FF-W-84.

F. FABRICATION, GENERAL

Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using industry proven details of fabrication and support. Use type of materials shown or specified for various components of work.

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, use phillips flat-head (countersunk) screws or bolts.

Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

G. PAINTING/COATING

All aluminum surfaces that will be in contact with concrete, steel or other dissimilar material shall be coated with asphaltic paint or aluminum impregnated caulking compound or other approved permanent insulation to prevent electrolytic action.

Additionally, Contractor shall be familiar with dissimilar metals corrosive issues and provide isolation materials or coatings appropriate to the installed project equipment and components to minimize future corrosion issues.

H. CHECKERED PLATE

Shall be standard checkered aluminum plate complete with angle frames and fasteners of thickness shown and located where shown on the drawings.

I. LADDERS

All ladders unless otherwise indicated, shall have flat bar side rails with eased edges spaced 20" o.c. with 3/4" diameter bar rungs welded to siderails at 12" o.c. maximum vertical spacing. Ladders shall be securely attached to supporting construction and extend at least 42" above top rung except where prohibited by overhead or other construction. Where steel ladders are required by the drawings, provide galvanized anchor bolts or expansion anchors. Where aluminum ladders are required by the drawings provide stainless steel anchor bolts or expansion anchors. 316 stainless ladders with 316 stainless steel anchor bolts are required in all wet well, vaults, manhole, water or wastewater holding structures where a ladder is called for.

J. GRATING

1. General: Use materials of the size and thickness shown, or if not shown, of the size recommended by NAAMM tables. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of the work. Comply with NAAMM "Metal Bar Grating Manual" and as herein specified.

   Except where noted otherwise, provide removable grating sections with end-banding bars for each panel, 4 saddle clip anchors designed to fit over 2 bearing bars, and 4 stud bolts with washers and nuts, unless otherwise indicated.

   Notch gratings for penetrations as indicated. Layout units to allow grating removal without disturbing items penetrating grating. All grating to be removable unless otherwise noted.

Provide banding for openings in grating separated by more than 4 bearing bars, of same material and size as bearing bars, unless otherwise indicated.

Notching of bearing bars at supports to maintain elevations will not be permitted.

Weld stud bolts to receive saddle clip anchors to supporting metal members.

2. Aluminum Grating: All aluminum grating shall be "Rectangular Pressure locked", KPL-19-4 Series, type as manufactured by Klemp Corporation; or equal. Bearing bar shall be 1¼" deep x 1/8" thick minimum spaced at 1-3/16" centers unless noted otherwise on the drawings. Provide aluminum clip anchors and stud bolts where grate is supported by aluminum members and stainless steel slip anchors and stud bolts where grade is supported by steel members. Coat surfaces in contact with concrete or steel with asphaltic paint or aluminum impregnated caulking compound or other approved permanent insulation. Stair treads to have checkered plate or abrasive nosings.

3. Aluminum Grating Treads: All aluminum grating treads shall be pressure-locked rectangular bar "KPL-19-4" as manufactured by "Klemp Corp." or equal. Bearing bars shall be 1-1/2" x 3/16" minimum unless noted otherwise on drawings. Treads shall have cast aluminum abrasive nosings.

4. To be considered equal a grating or tread must have the same load capacity as the size grating noted on the drawings. One type of grating shall be used throughout the job. The depth may vary from that shown on the drawings, provided adequate provisions are made to make modifications to the bearing and anchorage details.

K. PIPE RAILINGS

1. General: Fabricate pipe railings to dimensions and details shown, with smooth rounded bends and welded joints ground smooth and flush.

Adjust railings prior to anchoring to ensure matching alignment at butting joints. Space posts not more than 6'-0" on centers, unless otherwise shown. Plumb posts in each direction. Secure posts and rail ends to supporting construction as follows:

Anchor posts and rail ends into concrete with epoxy grout as detailed.

Provide removable railing sections as indicated. Furnish slip-fit metal socket or sleeve for casting into concrete. Accurately locate sleeves to match post spacing.

Secure single rail handrails to walls with wall brackets and end fittings. Provide brackets with not less than 3" clearance from inside face of handrail to the finish wall surface. Drill wall plate portion of bracket to receive bolt, unless indicated for concealed anchorage. Locate brackets as indicated or, if not indicated, at not more than 6' - 0' o.c. Provide flush-type wall return fittings with same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to supporting construction as follows:

For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.

For hollow masonry anchorage, use toggle bolts having square heads.

2. Aluminum Pipe Railings: Pipe handrails of aluminum shall be installed in the locations shown on the drawings.

   Horizontal aluminum handrails shall be 1 ½" schedule 40 pipe of aluminum alloy 6005-T5. Vertical posts to be 1 ½" schedule 80 pipe 6005-T5. Fittings shall be attached to the posts by internal welding. The various pieces of the rail shall be joined together by welding. After fabrication finish shall be a 180 grit belt grind with an Alumilite No. 204 Anodizing.

   Contractor may submit, for approval, 1 ½" square tube section handrail of the same strength as the 1 ½" pipe. Contractor shall be responsible for design of modifications to handrail anchor details to fit tube handrail. Submit modifications for approval of the Engineer.

L. STAIR NOSINGS

Provide cast aluminum abrasive nosings for all concrete stairs. All nosings are to be three (3) inches wide and have a one (1) inch lip. Nosings shall be the length of the tread less 3" at each end and have integral imbed anchors.

Abrasive is to be #20 aluminum oxide (AL203), integrally cast into the walking surface to a minimum depth of 1/32". Fastener screws shall not protrude above that tread surface. Cross-hatching and fluting shall be 1/16" deep minimum and shall be clean, sharp, well-defined and free from washes, scabs, buckles, blow holes, knots, cuts, cracks and pin-holes. Abrasive cast aluminum to have sand blasted finish. Abrasive cast iron to have one coat of shop black paint.

M. CONSTRUCTION CASTINGS

Provide cast iron manhole ladder rungs as detailed. See drawings for locations, sizes, types and details. Unless otherwise indicated, units shall be McKinley Iron Works, or Neenah Foundry Co, castings or equal. **Castings shall also meet currant ODOT and City of Tulsa/Sewer Operations standard requirements.**

END OF SECTION

205 SUBMITTALS

All submittals shall be accompanied by a transmittal letter and/or cover letter that includes the project name, bid item information/number and submittal number, the contract specification number under which the equipment is being supplied, the Equipment ID number of the equipment being referenced, and the submittal revision number as appropriate.

205.1 Contractor shall submit, for each bid item, the manufacturer's instructions and recommendations for installation, for subsequent testing of the units, and for ensuring they are in proper operation. These instructions shall be part of these specifications and binding on the contractor. All testing costs shall be included in the Contractors costs.

205.2 Contractor shall include, for each bid item, a work plan acceptable to the Engineer describing the duration and sequence of work. Plan shall be approved prior to commencement of work. All work requiring flow stoppage or removing equipment from service must be scheduled 48 hours in advance with Plant Superintendent. When flow stoppage is required for equipment installation, contractor shall have all necessary materials at the installation site prior to any flow stoppage, and shall proceed with installation of equipment to minimize downtime.

205.3 Contractor shall, within 15 days of issuance of Work Order, submit four (4) copies of the following items for review and approval - one (1) copy to be returned to Contractor following review, two (3) copies to be retained by Authority. At the Authority's sole opinion, electronic submittals may be selected:

205.3.1 Product Data and Information: Submit catalog data including rating and descriptive literature of all components and systems for approval by Authority. This shall include items required by specification section 204 Ancillary Equipment and Work.

205.3.2 Itemized list with manufacturer's part numbers, part descriptions and a schedule of values (unit prices) for the equipment and materials proposed for each location. The SOV shall be approved by the authority and will be used as the basis of periodical pay applications by the Contractor.

205.3.3 Shop Drawings: Submit the following shop drawings for approval by Authority:

205.3.3.1 Bill of materials including manufacturers' name and catalog number

205.3.3.2 Outline drawing showing dimensions, arrangement, and identification of components and nameplate schedule for all units

205.3.3.3 Individual schematic control diagrams for each unit.

205.3.3.4 Submittals should clearly identify items intended to be incorporated into the project. Mark or circle items clearly. Line through items or sizes that do not apply. Clearly identify where and what portion of the project the items are intended for use. Minimize "bundling" and separate important long lead time items out to coordinate and facilitate a review. Electrical and controls shall be submittal separately from related equipment.

205.3.4 Manufacturer's start up, certifications and training requirements:

Manufacture's certification that the equipment is suitable and will perform within specification and manufacturer's design operating parameters for the locations and conditions herein specified. Manufacture's services shall also include site visits by the Manufacture's *Technical Representative's* prior to construction, during installation and for start-up, as necessary for an inspection, detailed start up report and Manufacture's certification of proper installation. Submit the Manufactures start-up report(s) and certification(s) of proper installation when they become available to the Engineer and during the week the equipment being put into service. Included final copies of the Manufacture's Start-up Certificates in the final O&Ms. Start-up report/Manufacture's Certification should include pertinent start up details, inspection certifications, equipment description, location, project information, complete initial set points, initial operational readings, equipment numbers and date and other pertinent system information for future operations and maintenance.

Training shall also be provided for the equipment and systems installed. Submit a draft training agenda, draft handouts, power point/video and a Manufacturer's Technical Representative's resume for acceptance prior to scheduling the start-up and training. Provide two separate training days, as coordinated with the Plant to accommodate both day and night shifts. The duration of the training should be a minimum of 4 hours per

training day of classroom and field training or more, if recommended by the Manufacturer. A professional video services shall also be provided to cover both complete classroom and field training sessions. Deliverables are to Include; the full training video on DVD with the final O&Ms to the City. Provide additional standard Manufacturer's videos if available on the same DVD in the final O&M.

205.3.5 Safety Plan: This submittal will be checked for general conformance with Section 211 Safety requirements and applicable OSHA and local regulations. Notwithstanding, it is the Contractors responsibility to ensure that the plan is comprehensive and in full conformance with all applicable OSHA, federal, state and local regulations.

205.3.6 Work Plan: Submit for approval by Authority, the work plan clearly showing the work task sequencing plan and time requirements, including downtime durations. Draft work plans shall be submitted at least a month before any shut down or equipment being removed from service and provide opportunity for applicable coordination of the work. A time extension for additional contract time will not be granted for work not sufficiently planned and coordinated with the City and facility operations. This shall include items required by specification section 204.

205.3.7 Submit for approval by Authority, plans and specifications for any concrete pad, support, piping, or other construction modifications from original installation.

205.3.8 Warranty Equipment Log: Submit a preliminary draft within 60 calendar days from the issuing of the Notice to Proceed. The blank template form will be provided by the Owners Representative and is available upon request. A Warranty Equipment Log draft spreadsheet shall be built and completed by the Contractor with project equipment information and equipment numbers for review of the Authority. From that point on, the log will be updated each month by the Contractor and be a handout at the Monthly Meetings. Upon project completion, the Warranty Log spread sheet (in Excel) shall be completed with all required information such as equipment name, equipment tag name, equipment numbers, equipment manufacturer, equipment supplier/rep, start-up dates, training dates, O&M dates and other relevant information, then transmitted to the Owner for their future use in maintaining the

equipment. *The warranty log will be used as the tool to establish and agree on the equipment warranty period start date(s).*

205.3.9 Schedule of values: Submit for approval by the Authority prior to and for the pay application process a proposal bid item based schedule of values with appropriate breakdowns. Contractor will be required to make appropriate and sufficient breakdown based on bid items, areas of work, scope, Subcontractor efforts and such relevant information that the pay application process can be reviewed more easily, as directed by the Authority.

205.4 Operations and Maintenance Manual Submittals and deliverables:

205.4.1 Contractor shall furnish to the Engineer one soft searchable PDF of a preliminary Operation and Maintenance Manual complete for each piece of equipment, item, system and associated control systems furnished and installed for review, similar to and following 250 Submittals requirements above. Preliminary Operation and Maintenance manual submittals much be a completed draft searchable and tabbed version.

205.4.2 Contractor shall furnish and transmit to the Authority **Two (2) bound hard copies of all final O & M manuals, four (4) USB flash drive/memory cards to the City with the final O&M manuals along with final completed submittals and transmit a final electronically of the final O&Ms by email link to the City/Engineer.** All PDF documents shall be searchable within adobe software. An individual O&M package is required for each equipment at each City facility of the project (even if the same equipment is being installed at different plants or facility's). The USB flash drive/memory card shall be formatted in matching O&Ms; searchable pdf, tabbed sections and shall include matching all printed material included in the hard copies. A separate pdf folder shall be created for each **Equipment** numbered piece of equipment, within which all files pertaining to that piece of equipment shall be located.

205.4.3 The following Contractor's pay application percentages apply to the project, which include completed documentation work and deliverables as applicable to each individual equipment on the Contractor's pay

application schedule of value items (bid items) and as approved by the Engineer:

1) Any equipment payment item reaching 80% complete shall include: preliminary O&M manual submittal to the Engineer for approval with all the specified materials and contents per section 4.1, including the equipment summary sheet completed to extent possible. Submitted and approved preliminary O&Ms processed.

2) Any equipment payment item reaching 90% complete shall include: Equipment or system in functional service and Owner training completed.

3) Any equipment payment item reaching 100% complete shall include: Equipment fully in service, substantially completed, work scope completed completely and all SCADA - control functions working correctly and properly for an uninterrupted period of two weeks. Within 30 days after the Engineer's approval and Equipment being put in service, Contractor shall furnish to the Engineer the remaining four (4) hard copies of the final operations and maintenance manual and the three searchable tabbed PDF copies on CD/jump drives. Contractor shall submit any missing material for the manual prior to requesting certification of substantial completion on equipment with and requiring O&Ms, training and start-up. The last 10% of payment shall be for those items completed prior to applying for full payment of that item (100% payment).

205.4.4 Format and Contents: Each O&M manual shall include the following:

205.4.4.1 O&M Cover sheet. A standard Manufactures cover sheet may be used (as PDF), but it will need to be updated to include all of the following detail added to the cover sheet(s). See sample sheet included below.

a) Project Name

b) City project number and Contractor's contract number

c) Bid item number and specification number

d) Facility location

e) Equipment name

f) City's equipment number

g) Manufacture's name

h) Date of document (or installation)

{MANUFACTURER INFORMATION (Logo, etc.)}

{Name} OPERATION AND MAINTENANCE MANUAL

{Description of what is Included in O&M Manual}

To:
Project Contractor Name
Address
City, State Zip
Phone Number

Project Name and Location
PO#: (if applicable)

Manufacture Project Number (if applicable)

Submittal for fulfillment of specification section:
{Specification Section and Short Description}

Equipment List (if applicable)

Application	Type	Number	Equipment Tag #

Represented Locally By:
Supplier Name
Address
City, State Zip
Phone Number

Prepared By:
Manufacturer
Address
City, State Zip
Phone Number

Date

205.4.4.2 One copy of a completed **EQUIPMENT NAMEPLATE AND**

SUMMARY DATA form as the first page with the O&M. And directly behind that sheet a single sheet with generic site plan showing where the equipment was installed, with call outs to the site name, building/facility name and relative installation location information.

205.4.4.3 One copy of the equipment Start-Up report, Inspection form and Manufacture's certification of proper installation as applicable. Report should be and include information from startup and being put into service by the Manufacturer's Technical Representative. Documents should also include all initial set points, settings and data that is adjustable for future reference.

205.4.4.4 Index for pages, sections or tags as required.

205.4.4.5 One copy of the manufacturer's operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, troubleshooting, parts list and recommended spare parts.

205.4.4.6 List of electrical relay settings and control and alarm contact settings or any other initial set points or operational levels/elevations. Provide plan sheet(s) as applicable.

205.4.4.7 Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems

205.4.4.8 Record drawings showing as-built schematic control diagrams for each unit and one-line diagrams.

205.4.4.9 Cross-references where required between the appropriate sections of the Contractor's O&M manual and the manufacturers' manuals.

205.4.4.10 The Contractor shall provide all required warranty paperwork completed and filled in by the Contractor for the City's use. The completed warranty paperwork shall be specifically transmitted to the Plant Superintendent at time of start-up

equipment being put into service and a separate copy be provided within the Final O&Ms also transmitted to the City. The warranty document shall specifically name the City/Authority.

205.5. Equipment Nameplate Information – Contractor shall, upon startup of each piece of equipment, complete the form, titled **EQUIPMENT NAMEPLATE AND SUMMARY DATA**, found at the end of this section, and shall include the completed form in the front of that equipment's respective O & M manual. The form shall be included with each O & M manual copy submitted. Equipment ID nameplate requirements are found in specification section 204.3.6 of these specifications. Equipment tagging shall be installed prior to start up, training and equipment substantial completion.

205.6 Submittals shall be sent to the following address:

Holloway, Updike and Bellen, Inc.

2001 N Willow Ave.

Broken Arrow, OK 74012

(918) 251-0717

EQUIPMENT NAMEPLATE AND SUMMARY DATA

Equipment Name/Facility Location: _____

Equipment Number: _____

Description (Include size): _____

Project #: _____

Spec. #: _____

Vendor: _____

Manufacturer: _____

Model #: _____

***Item or Drawing #** _____

***Serial #**: _____

Purchase Price: $_____

Date Placed in Service (for 1-yr Warranty): _____

Manufacturer's Warranty Period and End Date: _____

Parts / Associated Details: _____

_____

_____

Maintenance Schedule

(May be an attached sheet from O&M Manual; do not use "See O&M Manual")

- ✓ Initial: _____
- ✓ Weekly: _____
- ✓ Monthly: _____
- ✓ Semi-Annual: _____
- ✓ Annual: _____

Applicable Motor Information: N.A. (Circle if not applicable)

Vendor: _____

Manufacturer: _____

Model #: _____

Item #: _____

Serial #: _____

Frame: _____ Insul. Class: _____

Volts/Hz/Amps: _____

HP / RPM / SF: _____

Manufacturer's Warranty Period and End Date: _____

***Item or Drawing #** may not be unique. For example, it may be the same for a group of same size valves or gates, each one having this same number that is unique to the group. The **Serial #** should be listed only when unique to this individual piece of equipment, otherwise it is N.A.

206 MONTHLY PROGRESS REPORTS AND PROGRESS MEETINGS

206.1 The Contractor shall submit monthly written project progress reports detailing the project's progress to date, problems encountered or anticipated which impact project schedule, and plans for the next two weeks' work.

206.2 Project progress reports shall be due as agreed upon during pre-work meeting.

206.3 Monthly progress meetings shall be scheduled on a weekday mutually agreeable to the Authority and the Contractor and shall be specified at the pre-work conference. The Contractor shall run the Monthly Meetings for the duration of the project and provide a meeting agenda including work completed, work planned, project, updated project schedule and other pertinent project status information.

206.4 The contractor shall submit a work progress and planned completion schedule for each bid item at the monthly progress meeting. The pre-work conference will constitute the first monthly progress meeting.

206.5 The Contractor shall maintain, update and submit an Equipment Log at each monthly meeting that lists each piece of equipment by Equipment ID number and lists Startup Date, Warranty Start Date and O&M Manual Submittal Date, among other project details. The spread sheet document shall be a shared document and submitted to the City at the end of the project for City's future use. A sample Equipment log is available upon request.

207 SECURITY

207.1 Each project site where work is to be performed under this Contract is a secured site. The Contractor shall be responsible for security as described in this section.

207.2 Site Access: The Contractor shall respect all existing security measures at each project site, and shall implement the following measures to apply to all work performed under this Contract. Coordination for Plant access and City of Tulsa security pass access will be required.

207.2.1 Work at both Northside and Southside shall be restricted to the hours defined by TMUA GC-19 unless otherwise authorized by the Plant Superintendent.

207.3 Common Requirements

207.3.1 Identification Badges: An Identification Badge, issued by the City of Tulsa Security Office, is required for the following people:

· The driver of each vehicle that will be entering the facility multiple times or on a regular basis.

· Sub-contractors and foremen that will be supervising other workers.

The Identification Badge also functions as an Access Card to allow access through the front gate of the facility. One year is the maximum time that an Access Card is active.

207.3.2 Contractor will coordinate with the Engineer to request Identification Badges. Application for an Identification Badge will require a background investigation. Each person that is applying for an Identification Badge will need to complete the following two (2) forms:

· City of Tulsa Access Card / Identification Card Request Form

· City of Tulsa Security, Background and Prescreen Investigation Form

A current soft copy of the forms can be obtained from the Engineer.

207.3.3 The Contractor will send the completed forms as required. Approved individuals will coordinate with the City of Tulsa Security Office to complete the process and obtain their Identification Badge.

207.3.4 The Contractor will coordinate with the Engineer to request reactivation of Access Cards. Reactivation may require re-application and additional background investigation.

207.4 Contractor shall maintain a log book listing as a minimum the names of all persons admitted to each secured site by the Contractor, the purpose of the site visit, the dates and times of arrival at the site, entry to the secured site, and departure from the site.

207.5 Contractor and Authority acknowledge that Contractor shall not solely be responsible for all secured access to the site, that City personnel will have access and will be performing their regular duties pertaining to the operation and maintenance of the site facilities, and that security at the site shall require the cooperation of all persons authorized to access the site for the performance of their work. To the extent the Contractor is responsible for and has control of secured access, Contractor shall restrict site access to only persons essential to the performance or inspection of the work being performed under this Contract.

207.6 Contractor shall provide Engineer twenty-four (24) hours advance notification or more as requested by WWTP staff of any delivery of equipment or materials to the

site, and shall make arrangements with Engineer to provide for inspection of such delivery.

207.7 Any observation by the Contractor of activity at or associated with the project site that Contractor observes and considers to be unusual or suspicious in nature, or that Contractor believes poses a threat to the integrity or welfare of the project site or associated facilities, shall be duly noted at the time of the observation in the log book identified in item B above. Any such observation shall be immediately reported to the Engineer.

207.8 No statement pertaining to security in these Specifications shall constitute a contract between Contractor and Authority for the performance of security services.

208 SAFETY

208.1 Contractor shall be responsible for performing all work under this contract in a safe manner and in compliance with all applicable local, state, and federal safety and health regulations. All of the following requirements shall apply:

208.2 Contractor shall submit a site safety plan prior to start of work. Contractor's attention is directed to safety regulations applicable to the work under this contract, which include but are not limited to the following:

208.2.1 OSHA Standards 29CFR1910.147, the control of hazardous energy (Lockout/Tagout)

208.2.2 Fire Prevention and Protection: The Contractor shall take all necessary measures to prevent fire, and shall provide satisfactory firefighting means at the location of work.

208.2.3 Condition of Equipment and Materials: All equipment, tools, and appliances, and materials used in connection with the project shall be handled and operated only when they are in safe operating condition and in accordance with a standard safety procedure.

208.2.4 Confined Space Entry: Contractor shall determine if any work areas in this contract are considered permit spaces for entry, as defined in OSHA regulations, and shall perform all work so determined in accordance with all applicable state and federal labor, safety, and health regulations. The Contractor shall transmit with each pay application all the months copies of the Contractors confined space permits to the City and at the end of the project with final pay application submittal a complete package of a copy

of all the project's Contactor confined space permits.

208.2.5 Combustible - Explosive Atmospheres: Contractor shall determine if any work areas in this contract are considered combustible and explosive spaces for entry, as defined in OSHA regulations, and shall perform all work and employ equipment in accordance with all applicable state and federal labor, safety, and health regulations.

209 PROTECTION OF PROPERTY

209.1 The protection of City, State and Government equipment, fences, gates, signs, and other City property is of prime importance, and if damaged, destroyed or removed, they shall be repaired, replaced, or paid for by the Contractor. Disturbance to this property must first be approved by the agency which controls it.

209.2 No valve or other control on any utility main or building service line shall be operated for any purpose by the Contractor.

209.3 At places where the Contractor's operations are adjacent to, or crossing, the plane of railway, telegraph, telephone, electric, and gas lines, or water lines, sanitary sewers, and storm sewers, damage to which might result in expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made. Contractor shall notify the Notification Center of Oklahoma One-Call System, Inc., of any excavation or demolition prior to the commencement of such work. Notification shall be made no sooner than then (10) days nor later than forty-eight (48) hours prior to start of work, excluding Saturdays, Sundays, and legal holidays.

209.4 The Authority has attempted to locate all storm sewers, culverts, buried telephone or electrical conduits, sanitary sewers, water mains, and gas mains that might interfere with the construction of this project. The Contractor shall cooperate with the owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a reasonable manner and duplication or rearrangement work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted.

209.5 It shall be the responsibility of the contractor to follow all rules and regulations set forth by the Oklahoma Department of Environmental Quality with regards to storm water runoff associated with construction activities involving the disturbance of land. The contractor shall review the regulations and determine if a DEQ storm water

discharge permit is required. If a permit is required, it is the responsibility of the contractor to apply for and obtain the permit prior to disturbance of soil. If a permit is not required, the contractor shall still take all necessary action to comply with DEQ rules.

209.6 In the event the contractor in any way fails to comply with the requirement of protecting, repairing, and restoring of any utility or utility service, the Engineer may, upon forty-eight (48) hours' notice, proceed to protect, repair, rebuild or otherwise restore such utility or utility service as may be deemed necessary, and the cost thereof will be deducted from any money due or which may become due the contractor pursuant to the terms of his contract.

210 PROTECTION OF MATERIALS

210.1 All materials and equipment delivered to the work site shall be adequately housed and protected against damage or deterioration as required by the equipment manufacturer. The Contractor shall keep his storage yard(s) in good order, arrange his materials neatly, and protect them from damage.

211 REFERENCES TO OTHER SPECIFICATION OR STANDARDS

211.1 Where a referenced American Society for Testing Materials (ASTM), National Electric Code (NEC), National Electrical Manufacturers Association (NEMA), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE), or other agency designated specification is specified for a material, component, or device, that designated specification shall be the current revision, either tentative or adopted. If a referenced specification is in disagreement with these specifications, the Tulsa Metropolitan Utility Authority specifications shall govern.

211.1 City of Tulsa standards and details, including specification 335, unless specifically noted differently in the plans and specifications herein.

212 CLEAN-UP

212.1 Immediately upon completion of the work at each site in the contract, the Contractor shall remove all excess materials, equipment, tools, and debris, and restore the site to a condition and in a manner satisfactory to the Engineer.

213 PLACING WORK IN SERVICE

213.1 If desired by the Authority, portions of the work may be returned to service when completed, and the Contractor shall give prior access to the work for this purpose,

but such use and operation shall not constitute an acceptance of the work. Any such return to service shall comply with Section GC-38 of the General Conditions of these Contract Documents and Specifications.

213.2 Warranty: All equipment and work shall have a one (1) year factory warranty from date of acceptance, which shall include all materials and labor unless more stringently specifically note elsewhere otherwise.

214 PAYMENT

214.1 Contractor shall submit a schedule of values for all major items of work as a basis for each partial payment. Payments will be made in accordance with section GC-29 of the General Conditions of these Contract Documents and Specifications. Contractor shall submit the SOV in sufficient time prior to the first pay application for the Engineer's review. Contractor should anticipate a typical submittal review durations for the projects SOV review.

214.2 Contractor's attention is directed to the Sales Tax Exemption Document in these Contract Documents and Specifications. Contractor shall have the option of instructing vendors to directly bill the Authority for materials the Contractor purchases while performing work under the terms of this Contract.

END OF SECTION


CITY OF
TULSA