

ADDENDUM NUMBER 1

TO THE CONTRACT DOCUMENTS

Date: March 17, 2021
JACOBS Project No.: 674133CH

for the
2016 AMP06 - Leeds Parkway Drive Pump Station SSO Abatement

To All Plan Holders:

The following changes, additions, and/or deletions are hereby made part of the Contract Documents for the 2016 AMP06 - Leeds Parkway Drive Pump Station SSO Abatement Project dated February 2021, as fully and completely as if the same set forth fully therein:

The following provides a summary of questions, answers, and clarifications:

Bid Form

1. Replace the Bid Proposal Section 00300 with the attached revised Section. The bid item for submittals was deleted and should be considered inherent to all other bid items. The pump station and equalization tank bid items were consolidated into two lump sum bid items. Casing sizes and bore lengths for trenchless crossings were also updated.

Specifications

1. Replace the Measurement and Payment Specification 01 25 00 with the attached revised Specification. Bid items were modified to align with the revised Bid Form.
2. Replace the Project Coordination Specification 01 31 13 with the attached revised Specification. Section was revised to include requirements to coordinate with ALDOT regarding upcoming paving plans at Dunnivant Road (SR-25).
3. Replace the Special Inspections Observation and Testing Specification 01 45 33 and supplemental tables with the attached revised Specification. This section was revised to clarify responsibility for testing and inspections. The Contractor is responsible for all testing and the Owner will provide Special Inspections and Observations.
4. Replace the Structural Concrete Specification 03 30 10 with the attached revised Specification. A waterproofing admixture product was added in section 2.02.A.3.b.
5. In Specification 09 66 01 (Monolithic Lining of Manholes and Pump Station Wet Wells), **REPLACE** paragraph 1.01.A with the following, *"A. To provide protection from hydrogen sulfide induced corrosion, a monolithic lining shall be applied to all new manholes, rehabilitated manholes, and the wet well."*
6. Replace the Instrumentation and Control for Process Systems Specification 40 90 01 with the attached revised Specification. Section 2.05 was modified to provide requirements for a new Mission Control System.

Drawing Modifications

1. Drawing C-06: Change callouts for steel casing diameter to 36" in both plan and profile.

Comments / Clarifications

1. See pre-bid meeting minutes attached. If questions from the pre-bid meeting are not included in this Addendum, they will be included in the next addendum.

Questions and Answers

The following questions were asked during the Pre-Bid Conference or emailed to the engineer with Jacobs responses provided:

| # | Question | Answer |
|---|---|---|
| 1 | Will Grundfos Pumps be considered as an approved pump for the project? | Flygt and ABS are currently the only two approved pump suppliers for Jefferson County Environmental Services Department. We are not reviewing equal or alternate pumps suppliers for this project and will move forward with the two approved. |
| 2 | Questions on Bolted Steel Storage Tank Specification: a. If a solid concrete mat foundation is desired, an embedded starter ring, concrete floor is more cost effective than a steel floor over a concrete mat. Would this be considered? b. Would an aluminum dome roof be considered if more cost effective? | a. Yes, an embedded starter ring would be considered. Contractor will need to include the cost for any design changes related to the slab in their bid as no compensation will be provided after award for increased costs associated with modifications to the foundation/slab. b. No, provide roof as specified. |
| 3 | Is there any wet well coating specified on the above referenced project? | See specification 09 66 01. |
| 4 | Provided that the as-built location survey of the instrumentation is performed by a AL registered surveyor, can the geotechnical Instrumentation (ground displacement monitoring and groundwater elevation monitoring) be provided by an AL registered P.E. with demonstrated experience in precise displacement monitoring via an automated monitoring system? | Yes. |
| 5 | Are all manholes to be monolithically lined? | All new or rehabilitated manholes and the wet well are to be monolithically lined per Specification 09 66 01. |

| # | Question | Answer |
|----|--|--|
| 6 | Section 44 42 55-1 on the standby engine driven pump and noticed that the spec is calling for a natural gas pump. Other parts of the spec are calling for either natural gas or diesel. Can you clarify this for me? | Standby pump shall be natural gas engine driven. |
| 7 | Would a prestressed concrete EQ tank be considered? | No. Provide bolted steel tank as specified in 33 16 13. |
| 8 | Bid proposal shows 50 LF of guided auger boring for the 8" force main, plans show 120 LF. | Change to 120 LF. See other changes to the bid form described above and attached hereto. |
| 9 | Will County consider extending due date for questions? | No. All questions are due by 5:00 pm on March 19, 2021. |
| 10 | Normally the county has a utility relocation allowance to pay for utility conflicts, holding poles etc., this time they do not. Does this mean the owners allowance will be used to pay for this? | Yes, if unforeseen and required to complete the work. |
| 11 | Please review the traffic control plan for Hwy 78, it appears as if there are four locations where this channelization takes place. We will have to close one lane the entire length of the job during working hours. There is no room to stage equipment/materials from the RR side of the ditch. | The Contractor is responsible for developing and submitting a traffic control plan sealed by an AL PE. See Specification 01 50 00. |
| 12 | The section of pipe adjacent to wall between barron industries and the storage warehouses (Dry Creek) will be difficult and will have to be "diverted" as we can't gamble there is no water even in "dry" months. The BMP's that I have seen on the drawings may not be enough as we will be using floating basin booms, Baffle fencing etc everything we can not to "muddy" the creek up. | <p>Bid Item 8 (Sediment and Erosion Control) will remain as lump sum bid items. Per Specification 01 57 13, The Contractor shall employ the services of an Engineer Licensed in the State of Alabama (a Qualified Credentialed Professional or QCP) to prepare all required permit application(s) and develop the Construction Best Management Practices Plan (CBMPP) for this Project. The QCP or their designated Qualified Credentialed Inspector (QCI) shall perform all required inspections as required by the CBMPP.</p> <p>I.e., the Contractor will be responsible for means and methods, including sediment and erosion control measures to comply with their permit and plan.</p> |

| # | Question | Answer |
|----|---|---|
| 13 | Who are we sending submittals too? | Hazen and Sawyer and the AMP Program Manager and Jacobs as the Engineer of Record. There will likely be an online document control system where submittals will be used by Contractor and Engineer for processing and tracking. |
| 14 | DOT notes state that work can only take place between 8:30 - 3:30, which is different than regular working hours stated in Specifications? | Work shall only take place between 8:30 - 3:30 when working within ALDOT ROW, unless approved otherwise by ALDOT. |
| 15 | Is blasting allowed? | No. |
| 16 | Is the pipe on Sheet C-18 a force main or gravity sewer? | It's a gravity sewer. |
| 17 | Confirm if sod is required for restoration in ALDOT ROW? | Yes, when restoring grassy areas within ALDOT ROW. |
| 18 | Provided that the as-built location survey of the instrumentation is performed by a AL registered surveyor, can the geotechnical Instrumentation (ground displacement monitoring and groundwater elevation monitoring) be provided by an AL registered P.E. with demonstrated experience in precise displacement monitoring via an automated monitoring system? | Yes. |

Jacobs



Derek Kelley, PE, CCM, PMP

Attachments

Pre-Bid Conference Minutes

Jefferson County Environmental Services Department Sanitary Sewer System – Asset Management Program – Contract No. 2016 AMP06 Leeds Parkway Drive Pump Station SSO Abatement March 17, 2021

- **Attendance**
- **The following items listed are for emphasis and discussion topics.**

00100 Notice to Bidders

1. The bid opening will be Wednesday, March 31, 2021 at 2:00 P.M. For the online bid submittal process, we are using QuestCDN. The bid opening will be via virtual video conference through Microsoft Teams, which can be accessed using a direct invitation link sent via email. Bidders can request a link from Tad Powell, PE tpowell@hazenandsawyer.com.
2. Questions will be received until Friday, March 19, 2021 at 5:00 P.M.
3. Contract time is 335 consecutive calendar days from Notice to Proceed to achieve Substantial Completion and 365 consecutive calendar days to achieve Final Acceptance.
4. This project is classified as a Class “D” (Pump Station and Package Plant Facility). Bidders must be pre-qualified for Class “D” to bid on this project. The prospective bidder or its subcontractor must also be qualified to construct, at a minimum, Class “B” sewer line projects.

00101 Instructions to Bidders

5. Each Bid Proposal will be completed online at QuestCDN and will consist of the following documents as listed in Article 1.03 (online Quest bidding will be made available on or before 03/26/21):
 - a. Bid Envelope Information
 - b. Section 00300 – Bid Proposal (00300-1 and 00300-3 will be filled out and submitted as a PDF but the unit prices will be entered directly into the Quest bid proposal form)
 - c. Section 00350 – Non-Collusion Affidavit
 - d. Section 00360 – MBE/DBE Documentation Statement Jefferson County Commission ESD
 - e. Section 00410 – Bid Bond
 - f. Section 00430 – List of Subcontractors
 - g. Appendix A – Jefferson County Environmental Services Department MBE/DBE Form A
 - h. Appendix B – State of Alabama Resident Status Form
 - i. Appendix C – Jefferson County, Alabama – Equal Employment Opportunity Certification Form
6. During construction, quantities may be increased or decreased without invalidating the bid prices.
7. Bid Proposals may be considered irregular and rejected if the Bid Proposal contains unit prices that are obviously unbalanced.
8. The Owner reserves the right to reject any and all Bid Proposals and the right to waive technicalities and/or informalities, if such waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the letting of construction contracts.
9. Owner has 75 days to award the contract.

00630 MBE DBE Program

10. Submit Form E today (Appendix A). Email form to tpowell@hazenandsawyer.com.

00700 General Conditions

11. The award of the Contract, if awarded, will be to the lowest responsible, responsive Bidder. No Notice of Award will be given until the Owner has concluded such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of the Bidder to do the Work in accordance with the Contract Documents to the satisfaction of the Owner within the time prescribed. The Owner reserves the right to reject the Bid Proposal of any Bidder who does not pass such investigation to the Owner's satisfaction.
12. Any agreements with property owners must be in writing and supplied to the Engineer upon request.

00820 Special Conditions

13. Liquidated damages are \$1,500/day.
14. Contractor's shall provide at least 48-hour notice on company letterhead to property owners.
15. All activities shall be performed in accordance with the manufacturer's recommendations and regulations established by OSHA, with particular attention to excavations and confined spaces.
16. Unpermitted sewage discharge penalties are \$1,000/day for the first 30 days. The Contractor shall owe the unpermitted discharge penalty to the Owner when the Owner reports any unpermitted discharge caused by the actions of the Contractor as an unpermitted discharge to USEPA.

01010 Summary of Work

17. The project is located near the intersections of Parkway Drive and AL-25 and the intersection of Parkway Drive and AL-119 in Leeds, AL.
18. The major items of the Work to be performed under this proposed Contract include:
 - a. Preparation and submission of submittals for review and approval.
 - b. Surveying.
 - c. Obtaining construction stormwater permit from the Alabama Department of Environmental Management, implementation of a Construction Best Management Practices Plan (CBMPP) for erosion and sediment control, and monitoring and maintenance of the erosion control measures.
 - d. Installation of new gravity sewers:
 - i. Sizes and Footage Include:
 1. 4,600 linear feet of 10-inch and 12-inch
 2. 400 linear feet of 8-inch.
 3. 1,100 linear feet of 16-inch.
 - ii. Installation and lining of manholes.
 - iii. Installation approaches include:
 1. Open cut, new alignment.
 2. Open cut, same trench replacement.
 3. Trenchless.
 - e. Development and implementation of a traffic control plan.
 - f. Construction of a new 1 mgd submersible type pump station. Work includes:
 - i. Site preparation.
 - ii. Construction of a retaining wall.

- iii. Placement of engineered fill to build site above the 100-year flood elevation.
- iv. Construction of a cast-in-place pump station, wet well, and valve vault.
- v. Installation of pumps, piping, valves and appurtenances.
- vi. Installation of a 200,000 gallon bolted steel equalization tank and associated pumping system and automated draining system.
- vii. Natural Gas Generator.
- viii. Electrical gear.
- ix. Instrumentation and Controls.
- x. Concrete pavement.
- xi. Security fencing.
- g. Installation of approx. 800 LF of 8-inch force main by open cut and trenchless methods.
- h. Replacement of two existing air release valves and associated manholes.
- i. Demolition of the existing sewer system assets to be abandoned include two pump stations and manholes. Includes filling sewer lines with flowable fill.
- j. Delivery of equipment from existing pump station to Jefferson County.
- k. Management of excess excavated material and testing this material for lead. Disposal of excess excavated material at a permitted site.
- l. Storage and testing of groundwater for lead. Disposal of contaminated water at a permitted facility.
- m. Restoration to include paving, retaining wall replacement, grassing and stabilization of other areas where disturbed by work completed as part of this Project.
- n. System startup and performance testing.
- o. Preparation of record drawings/as constructed of the installed gravity sewer and force main by a licensed surveyor.

01 15 00 Prosecution and Progress

- 19. Normal time of work shall generally be between 7am and 6pm Monday through Friday.
- 20. Work at night, on weekends, or holidays will only be allowed for special circumstances and must be requested and agreed upon in writing well in advance of the work activity.

01 25 00 Measurement and Payment

- 21. Actual quantities and measurements supplied or placed in the Work and verified by the Engineer may differ from the estimated quantities and shall be the basis for payment.
- 22. Generally, one request for progress payment per month is anticipated.
- 23. Descriptions of the bid items are included in the Measurement and Payment specification.

01 28 00 Change Order Procedures

- 24. A field directive instructs Contractor to proceed with a change. Contractor shall promptly execute the field directive. The field directive can add time but not change the Contract amount.

01 31 13 Project Coordination

- 25. Excavation of the pump station site along with the sections that parallel Dry Creek shall be performed during typical dry periods of the year (July to November) to minimize the volume of ground water that must be managed.
- 26. All tree clearing shall be completed between November 1 and March 31. The County is working on getting trees suitable for bat roosting cut down before March 31, 2021.

01 31 19 Project Meetings

27. Preconstruction, monthly progress, and some pre-installation meetings will be required.

01 32 00 Construction Progress Documentation

28. At the Preconstruction Meeting, the Contractor shall provide the first timely and acceptable schedule. An updated monthly schedule will be required with each pay request. The Contractor must produce and update a full schedule for the project.

01 33 00 Submittals

29. Submittals may be submitted electronically, except for samples and color charts.

30. All submittals shall be thoroughly checked by the Contractor and shall bear the Contractor's stamp of approval certifying they have been checked.

01 50 00 Temporary Facilities and Controls

31. The applicant must comply with the Manual on Uniform Traffic Control Devices. All devices must be in place prior to start of construction and shall be properly maintained by applicant during construction.

32. Contractor shall submit a Traffic Control Plan, sealed by an AL professional engineer.

01 57 13 Temporary Environmental Controls

33. Contractor shall employ the services of an AL PE to prepare permit applications and CBMPP.

01 57 15 Soil and Groundwater Management, Testing and Disposal

34. The sewer construction to be completed to the East of the Norfolk Southern Railroad within Borden Ave., Dunnivant and parallel to US Highway 78 is located within the vicinity of two sites that contributed to the lead contamination of the soil and groundwater within the area.

35. Contractor shall employ an Environmental Professional to develop a management plan for soil and groundwater.

36. Plan to construct these portions of the sewer during dry months (July to November).

01 57 28 Temporary Sanitary Sewer Flow Control

37. Temporary flow control will be required throughout the project. Maintain sewer flow around Work area in a manner that will not cause surcharging of sewer, damage to sewer, and that will protect public and private property from damage.

01 77 00 Project Record Documents

38. Contractor shall keep and maintain a full size set of Drawings as the as-built record of day-to-day construction progress. These prints shall be delivered to the Engineer upon completion of the Project. The Record Drawings shall indicate all as-installed elevations, finish grades, etc., with Contractor's AL PLS's certification and seal. Operate and maintain 24-hours per day, 7 days per week, including holidays, as required, to control flow.

01 91 14 Equipment Testing and Facility Startup

39. Prior to facility turnover, all functional testing, certificates of proper installation, spare parts and O&M manuals turnover, facility performance demonstration, and training must be completed.

CLARIFICATIONS/COMMENTS

40. The first Addenda will be issued this week with Engineer's answers to Bidder questions.

QUESTIONS – see Q&A included in Addendum 1.

SECTION 00300

BID PROPOSAL

DATE: ____ / ____ / ____

TO: The Commission of
Jefferson County
Birmingham, Alabama

Gentlemen:

In response to your request the undersigned Bidder submits this Bid Proposal for the **2016 AMP06 - Leeds Parkway Drive Pump Station SSO Abatement Project** as described and specified in the Drawings and Specifications:

1. Bidder proposes and agrees, in the event this Bid Proposal be accepted, to enter into a Contract with the above named Commission (herein designated and referred to as the Owner), in the form herein specified, to furnish all materials, equipment, machinery, tools, means of transportation, power and fuel, and to perform all labor necessary for or incidental to the construction of the aforementioned improvements, all in complete accordance with the requirements of the Contract Documents, to the entire satisfaction of the Owner, at the unit and lump sum prices we have inserted opposite each item of work listed in the accompanying Bid Proposal Form, which is an integral part of this Bid Proposal.
2. In submitting this Bid Proposal, the Bidder understands and agrees that a Contract may be awarded for the Work as may appear to the interest of the Owner; that the quantities as stated are approximate only; that no claim shall be made against the Owner on account of any excess or deficiency, either absolute or relative, therein; that the estimated quantities will be used as a basis for canvassing and evaluating Bid Proposals and for determining the estimated amount of the Contract; and that, within the limits of available funds, the Owner reserves the right to increase or decrease the estimated quantities by such amounts as may be necessary to complete the Work, provided, however, that the stated unit prices shall remain firm and unchanged.
3. Bidder hereby declares that the only person or persons interested in this Bid Proposal as principal or principals is, or are, named herein and that no other person than herein mentioned has any interest in this Bid Proposal or in the Contract to be entered into, that this Bid Proposal is made without connection with any other person, company, or parties making Bid Proposal, and that this Bid Proposal is in all respects fair and made in good faith without collusion or fraud.

4. Bidder further declares that he has examined the site of the Work and the building and labor conditions and has informed himself fully in regard to all conditions pertaining to the place where the Work is to be done; that he has examined the Drawings and these Specifications for the Work and other Contract Documents relating thereto and has read all Special Conditions furnished prior to the opening of bids; and that he has satisfied himself relative to the Work to be performed.
5. Bidder further proposes and agrees that, if awarded a Contract for this project, he will commence Work immediately on or before the date stated in a written notice from the Owner to commence Work; that he will furnish all materials, and perform all labor for the completion of the Contract and will complete same, including all accepted alternates thereto, within the time stated in the Special Conditions; and that on his failure to complete the Work within such time he will pay to the Owner for each calendar day that the Work, or any part thereof remains uncompleted beyond such specified time, the amount specified in the Special Conditions; this payment shall be made as liquidated damages.
6. The Bidder further declares that accompanying this Bid Proposal is a certified check or satisfactory Bid Bond in the sum of five percent (5%) of this Bid Proposal, not to exceed \$10,000.00 and it is hereby agreed that in case of the withdrawal of this Bid Proposal without the consent of the Owner within seventy-five (75) days after the Bid opening, or that in case of failure on the part of the undersigned to execute the Contract as aforesaid and to deliver same and the required security for the faithful performance of the Contract (executed in the form annexed hereto), to said Owner within ten days from the date a notice of acceptance of this Bid Proposal is given to the undersigned personally, or by mail to the address as herein stated, then the undersigned Bidder will be deemed to have abandoned the Contract, and thereupon the amount of such check or bond shall be absolutely due and payable thereunder to the Owner.
7. The Bidder further declares his understanding that the Bid Proposal may contain quantities for Bid Items that exceed the quantities identified in the Contract Documents. If applicable, the quantities that are not shown in the Contract Documents may be identified by the Owner and/or Engineer and, if so identified, will be completed in this Contract.

Individual or Firm Name of Bidder

Bidder's Address _____

Bidder's Telephone Number (include area code): _____

Bidder's Email Address: _____

Bidder's State of Alabama License Number: _____

Licensed to be awarded Contracts not exceeding: _____

Note: If the Bidder is a corporation, give the following information:

State in which incorporated: _____

Address of Principal Office: _____

The Contractor is advised that TIME IS OF THE ESSENCE on this project and that the Contract time of **335** consecutive calendar days from the effective date of the written Notice to Proceed to achieve Substantial Completion and **365** consecutive calendar days from the effective date of the written Notice to Proceed to achieve Final Acceptance shall be strictly observed. LIQUIDATED DAMAGES WILL BE ASSESSED IF THE CONTRACT TIME IS EXCEEDED. The Contractor may apply for an extension of time in accordance with provisions of the Contract and these Specifications; however, such an extension of time must be approved PRIOR to the Contract completion date to avoid the imposition of liquidated damages. The Contractor is referred to the Special Conditions.

Bidder has examined the following addenda, and receipt of them is acknowledged:

| | | | |
|-----------|-------------|-----------|-------------|
| No. _____ | Dated _____ | No. _____ | Dated _____ |
| No. _____ | Dated _____ | No. _____ | Dated _____ |
| No. _____ | Dated _____ | No. _____ | Dated _____ |
| No. _____ | Dated _____ | No. _____ | Dated _____ |

Signature of Bidder: _____

BID PROPOSAL FORM

2016 AMP06 - Leeds Parkway Drive Pump Station SSO Abatement Project

All Bid Items shall include costs for furnishing to Owner all materials, equipment, and supplies and for all costs incurred in completing the Work, including installation of all materials, equipment, and supplies furnished, complete in-place and ready for continuous service, and all other labor, [submittals](#), permit fees, taxes, insurance, miscellaneous costs, overhead, and profit.

| No. | Item | Unit | Quantity | Unit Price | Total Item Price |
|--------------------|---|------|-------------------|------------|------------------|
| 1 | Mobilization/Demobilization | LS | 1 | \$ | \$ |
| | Gravity Mains | | | | |
| | a. 8-inch Direct Bury along Borden Ave. | LF | 361 | \$ | \$ |
| | b. 12-inch Direct Bury along Dunnavant Road | LF | 360 | \$ | \$ |
| | c. 12-inch Direct Bury along U.S. Highway 78 | LF | 1924 | \$ | \$ |
| | d. 16-inch Direct Bury from Pump Station to Norfolk Southern Undercrossing | LF | 712 | \$ | \$ |
| | e. 10-inch Direct Bury from Pump Station to City Hall Pump Station | LF | 1430 | \$ | \$ |
| | f. 16-inch and 20-inch Direct Bury at Ashville Road | LF | 237 | \$ | \$ |
| 23 | g. 16-inch Carrier/36-inch Casing - Railroad Spur Trenchless Undercrossing | | | | |
| | Trenchless Undercrossing | LF | 119 | \$ | \$ |
| | Workshafts | EA | 2 | \$ | \$ |
| | h. 16-inch Carrier/36-inch Casing - Norfolk Southern Trenchless Undercrossing | | | | |
| | Trenchless Undercrossing | LF | 287 67 | \$ | \$ |
| | Workshafts | EA | 2 | \$ | \$ |
| | i. 12-inch Carrier/ 36 24-inch Casing - Dry Creek Trenchless Undercrossing | | | | |
| | Trenchless Undercrossing | LF | 182 | \$ | \$ |
| | Workshafts | EA | 2 | \$ | \$ |
| | j. 12-inch Carrier/ 36 24-inch Casing - U.S. Highway 78 Trenchless Undercrossing | | | | |

| No. | Item | Unit | Quantity | Unit Price | Total Item Price |
|-----|--|------|-------------------|------------|------------------|
| | Trenchless Undercrossing | LF | 50 54 | \$ | \$ |
| | Workshafts | EA | 2 | \$ | \$ |
| | Force Main | | | | |
| | a. 8-inch Installed by Open Cut | LF | 670 | \$ | \$ |
| | b. 8-inch Carrier/ 24-inch Casing Trenchless Undercrossing | | | | |
| 34 | Trenchless Undercrossing | LF | 120 50 | \$ | \$ |
| | Workshafts | EA | 2 | \$ | \$ |
| | c. Combination Air Release Valves | EA | 4 | \$ | \$ |
| | Dewatering/Groundwater Control and Management | | | | |
| | a. Dewatering of Trenches | LS | 1 | \$ | \$ |
| 45 | b. Dewatering of Pump Station | LS | 1 | \$ | \$ |
| | c. Excess Water Management | LS | 1 | \$ | \$ |
| | d. Lead Contaminated Water Disposal | GAL | 150,000 | \$ | \$ |
| 56 | Traffic Control Facilities and Traffic Control Plan | LS | 1 | \$ | \$ |
| | Soil Management | | | | |
| | a. Hauling and Stockpiling | LS | 1 | \$ | \$ |
| 67 | b. Testing | EA | 25 | \$ | \$ |
| | c. Disposal of Clean Soil | CY | 1,500 | \$ | \$ |
| | d. Disposal of Contaminated Soil | CY | 1,500 | \$ | \$ |
| 78 | Survey – Control and As Constructed Drawings | LS | 1 | \$ | \$ |
| | Erosion and Sediment Control | | | | |
| 89 | a. Permit and CBMPP | LS | 1 | \$ | \$ |
| | b. Installation, Maintenance and Removal | LS | 1 | \$ | \$ |
| 910 | Demolition | LS | 1 | \$ | \$ |

| No. | Item | Unit | Quantity | Unit Price | Total Item Price |
|---|--|-----------|----------|------------|------------------|
| 10 4 | Manholes | EA | 42 | \$ | \$ |
| 11 2 | Final Site Restoration | | | | |
| | a. Grass | LS | 1 | \$ | \$ |
| | b. Asphalt Pavement Outside of ALDOT ROW | SY | 4000 | \$ | \$ |
| | c. Asphalt Pavement within ALDOT ROW | SY | 1400 | \$ | \$ |
| | d. Graveled Surface Restoration | SY | 800 | \$ | \$ |
| | e. Concrete Retaining Wall and Creek Bank Restoration | LS | 1 | \$ | \$ |
| 12 | <u>Pump Station and Site Improvements</u> | <u>LS</u> | <u>1</u> | <u>\$</u> | <u>\$</u> |
| 13 | <u>Equalization Tank and Pumping System</u> | <u>LS</u> | <u>1</u> | <u>\$</u> | <u>\$</u> |
| 14 4 | Sanitary Sewer Flow Bypass Pumping/Flow Control | LS | 1 | \$ | \$ |
| 15 5 | Quality Control Testing by Contractor's Independent Testing Laboratory | LS | 1 | \$ | \$ |
| 16 6 | Owner's Allowance | | | | \$400,000.00 |
| Total Bid Amount (Sum of Items 1 Through 16) | | | | | \$ |

In the event of a discrepancy between the unit price bid and the extended total amount, the unit price will be deemed intended by the bidder and the extended total amount shall be adjusted. In the event of a discrepancy between the sum of the extended amounts and the Grand Total of Bid, the sum of the extended amounts shall govern.

END OF SECTION

**SECTION 01 25 00
MEASUREMENT AND PAYMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Authority.
- B. Unit Quantities Specified.
- C. Measurement of Quantities.
- D. Scope of Payment.
- E. Compensation for Altered Quantities.
- F. Payment for Omitted Items.
- G. Claims for Extra Work.
- H. Payment for Extra Work.
- I. Partial Payments (Estimates).
- J. Retainage.
- K. Payment for Materials Stored.
- L. Final Payment.
- M. Claims for Adjustment and Disputes.
- N. Prohibited Interest.
- O. Buy American Clause.
- P. Defect Assessment.
- Q. Non-Payment for Rejected Products.

1.02 RELATED SECTIONS

- A. Section 01 27 00, Application for Payment.
- B. Section 01 28 00, Change Order Procedures.

1.03 AUTHORITY

- A. Measurement methods delineated in the individual Specification sections are intended to complement the criteria of this section. In the event of conflict, the requirements of the individual Specification section shall govern.

1.04 SUBMITTALS

A. Informational Submittals:

1. Schedule of Values: Submit on Contractor's standard form.
2. Application for Payment.
3. Final Application for Payment.

1.05 SCHEDULE OF VALUES

- A. Prepare a Schedule of Values for all work being performed as part of the Agreement.
- B. Upon request of Engineer, provide documentation to support the accuracy of the Schedule of Values.
- C. Lump Sum Work: List bonds and insurance premiums, mobilization, demobilization, contract closeout, separately.
- D. An unbalanced or front-end loaded schedule will not be acceptable.
- E. Summation of the complete Schedule of Values representing all the Work in the agreement shall equal the Contract Price.

1.06 MEASUREMENT OF QUANTITIES

- A. Where applicable, the determination of quantities of Work acceptably completed under the terms of the Contract will be made by the Engineer, based on measurements taken by him or his assistants. These measurements will be taken according to the United States standard measurements and in the manner as specified in these Specifications.
- B. Measurement Devices:
 1. Scales shall be inspected, tested, and certified by the applicable Weights and Measures Department within the past year and shall be of sufficient size and capacity to accommodate the conveying vehicle.
 2. Metering devices shall be inspected, tested, and certified by the applicable department within the past year.
- C. Volume shall be determined by cubic dimension by multiplying mean length by mean width by mean height or thickness.
- D. Area shall be determined by square dimension by multiplying mean length by mean width or height.
- E. Linear measurement shall be measured by linear dimension, along the item centerline or mean chord.
- F. Stipulated price measurement shall include items measured by number, weight, volume, area, length, or combination thereof, as appropriate.

1.07 MEASUREMENT FOR PAYMENT

- A. The lump sum and unit prices shown in the Bid shall reflect the entire cost for the construction of the complete Work. Costs for items called for in or reasonable inferred as necessary from the construction documents for which a specific unit price is not listed in the Bid shall be included in the price of the closest applicable bid item.
- B. The following sum of the items that are subsidiary to the whole Work. The cost of these items shall be balanced throughout the separate pay items:
1. Insurance, permits and licenses.
 2. Obtaining and maintaining access / easement agreements not provided for and required based upon contractor's means and methods and to access easements provided.
 3. Contractor's supervision, progress schedules and site meetings.
 4. Control of Water/Dewatering where not specified in the items.
 5. Geotechnical testing were not specified in the items.
 6. Environmental controls – dust control, noise control and cleanup.
 7. Protection and restoration of existing utilities damaged by construction activities.
 8. Pre-construction and progress photos.
 - 8.9. Submittals.
- C. The following is a description of the measurement and subsidiary work associated with each of the Bid Items:

| No. | Item | Unit | Description |
|-----------|-----------------------------|------|---|
| 1 | Mobilization/Demobilization | LS | The Work shall consist of the mobilization and demobilization of the Contractor's forces, equipment, and performance and payment bonding necessary for performing the work required under the Contract. Mobilization shall include temporary facilities as specified in Section 01 50 00, Temporary Facilities and Controls with the exception of the Traffic Control Facilities and Traffic Control Plan. This item is covered under a separate bid item below. Demobilization shall include removal of temporary facilities and completion of closeout procedures specified in Section 01 77 00, Closeout Procedures. Total payment for this bid item will not exceed 5 percent of the contractor's base bid price. Payments for mobilization shall not exceed 75 percent of the total for this bid item. A minimum of 25 percent of this bid item will be retained until such time that demobilization is complete and the areas disturbed have been fully restored and accepted by the Owner. |
| <u>23</u> | Gravity Mains | | |

| No. | Item | Unit | Description |
|-----|--|------|--|
| | a. 8-inch Direct Bury along Borden Avenue | LF | Work item includes all labor, pipe and other materials and equipment associated with the installation of the specified ductile iron pipe (DIP) along Borden Avenue to the tie into the 12-inch main in Dunnivant Avenue by open cut, direct burial. Item includes all excavation, pipe, fittings, pipe bedding, pipe zone material, backfill, warning tape, and pipe leakage testing. Dewatering/groundwater control, excess excavated soil, manholes, traffic control and paving are a separate payment item. |
| | b. 12-inch Direct Bury along Dunnivant Road | LF | Work item includes all labor, pipe and other materials and equipment associated with the installation of the specified ductile iron pipe (DIP) along Dunnivant Road to the tie into the 16-inch main by open cut, direct burial. Item includes all excavation, pipe, fittings, pipe bedding, pipe zone material, backfill, warning tape, and pipe leakage testing. Dewatering/groundwater control, excess excavated soil, manholes, traffic control and paving are a separate payment item. |
| | c. 12-inch Direct Bury Along U.S. Highway 78 | LF | Work item includes all labor, pipe and other materials and equipment associated with the installation of the specified ductile iron pipe (DIP) along U.S. Highway 78 to the trenchless undercrossing of the main under Dry Creek by open cut, direct burial. Item includes all excavation, pipe, fittings, pipe bedding, pipe zone material, backfill, warning tape, and pipe leakage testing. Dewatering/groundwater control, excess excavated soil, manholes, traffic control and paving are a separate payment item. |
| | d. 16-inch Direct Bury from Pump Station to Norfolk Southern Undercrossing | LF | Work item includes all labor, pipe and other materials and equipment associated with the installation of the specified ductile iron pipe (DIP) from the pump station to the trenchless undercrossing the Norfolk Southern Railroad by open cut, direct burial. Item includes all excavation, pipe, fittings, plug valve in manhole, pipe bedding, pipe zone material, backfill, warning tape, and pipe leakage testing. Dewatering/groundwater control, excess excavated soil, manholes, traffic control and paving are a separate payment item. |

| No. | Item | Unit | Description |
|--|--|------|--|
| | e. 10-inch Direct Bury From Pump Station to City Hall Pump Station | LF | Work item includes all labor, pipe and other materials and equipment associated with the installation of the specified ductile iron pipe (DIP) from the pump station to the City Hall Lift Station along with the interconnections to the existing sewers by open cut, direct burial. Item includes all excavation, pipe, concrete encasement, fittings, plug valve in manhole, pipe bedding, pipe zone material, backfill, warning tape, and pipe leakage testing. Dewatering/groundwater control, excess excavated soil, manholes, traffic control and paving are a separate payment item. |
| | f. 16-inch and 20-inch Direct Bury at Ashville Road | LF | Work item includes all labor, pipe and other materials and equipment associated with the installation of the specified ductile iron pipe (DIP) from at Ashville Road to replace the existing sewer along with the connection to the existing 24-inch sewer by open cut, direct burial. Item includes all excavation, pipe, concrete encasement, fittings, pipe bedding, pipe zone material, backfill, warning tape, and pipe leakage testing. Dewatering/groundwater control, excess excavated soil management and disposal, manholes, traffic control and paving are a separate payment item. |
| g. 16-inch Carrier/36-inch Casing - Railroad Spur Trenchless Undercrossing | | | |
| | Trenchless Undercrossing | LF | Work item includes all labor, materials and equipment required for completion of the cased crossing under the Railroad Spur. This includes the boring, casing, spacers, end seals, with the DIP, grout and other items as detailed and specified. |
| | Workshafts | EA | Work item includes all excavation, excavation support system and other work associated and required for construction of the work shafts/work areas. Item includes all backfill. Dewatering/groundwater control, excess excavated soil management and disposal, manholes, traffic control and paving are a separate payment item. |
| h. 16-inch Carrier/36-inch Casing - Norfolk Sothern Trenchless Undercrossing | | | |
| | Trenchless Undercrossing | LF | Work item includes all labor, materials and equipment required for completion of the cased crossing under the Dunnavant Road and Norfolk Southern. This includes the boring, casing, spacers, end seals, with the DIP, grout and other items as detailed and specified. |

| No. | Item | Unit | Description |
|--|--------------------------|------|--|
| | Workshafts | EA | Work item includes all excavation, excavation support system and other work associated and required for construction of the work shafts/work areas. Item includes all backfill. Dewatering/groundwater control, excess excavated soil management and disposal, manholes, traffic control and paving are a separate payment item. |
| i. 12-inch Carrier/24-inch Casing - Dry Creek Trenchless Undercrossing | | | |
| | Trenchless Undercrossing | LF | Work item includes all labor, materials and equipment required for completion of the cased crossing under Dry Creek. This includes the boring, casing, spacers, end seals, with the DIP pipe, grout and other items as detailed and specified. |
| | Workshafts | EA | Work item includes all excavation, excavation support system and other work associated and required for construction of the work shafts/work areas. Item includes all backfill. Dewatering/groundwater control, excess excavated soil management and disposal, manholes, traffic control and paving are a separate payment item. |
| j. 12-inch Carrier/24-inch Casing - U.S. Highway 78 Trenchless Undercrossing | | | |
| | Trenchless Undercrossing | LF | Work item includes all labor, materials and equipment required for completion of the cased crossing under U.S. Highway 78. This includes the boring, casing, spacers, end seals, with the DIP pipe, grout and other items as detailed and specified. |
| | Workshafts | EA | Work item includes all excavation, excavation support system and other work associated and required for construction of the work shafts/work areas. Item includes all backfill. Dewatering/groundwater control, excess excavated soil management and disposal, manholes, traffic control and paving are a separate payment item. |

| No. | Item | Unit | Description |
|-----------------------------------|--|---|---|
| <u>34</u> | Force Main | | |
| | a. 8-inch Installed by Open Cut | LF | Work item includes all labor, pipe and other materials and equipment associated with the installation of the specified ductile iron pipe (DIP) force main from the pump station to the tie in to the existing 8-inch force main. Item includes the new section of force main installed at the downstream end of the existing force main at the tie in to the new gravity main. Item includes mid span restrains, isolation valves, bypass connection and associated manhole along with all bends and fittings. Item includes all excavation, pipe, fittings, pipe bedding, pipe zone material, backfill, warning tape, and pipe leakage testing. Dewatering/groundwater control, excess excavated soil, manholes, traffic control and paving are a separate payment item. |
| | b. 8-inch Carrier/ 24-inch Casing Trenchless Undercrossing | | |
| | Trenchless Undercrossing | LF | Work item includes all labor, materials and equipment required for completion of the cased crossing under U.S. Highway 78. This includes the boring, casing, spacers, end seals, with the DIP pipe, grout and other items as detailed and specified. |
| | Workshafts | EA | Work item includes all excavation, excavation support system and other work associated and required for construction of the work shafts/work areas. Item includes all backfill. Dewatering/groundwater control, excess excavated soil management and disposal, manholes, traffic control and paving are a separate payment item. |
| c. Combination Air Release Valves | EA | Work item includes all labor, material and equipment required for installation of the detailed and specified combination air release valves along the new and existing force main. Dewatering/groundwater control, excess excavated soil management and disposal, manholes, traffic control and paving are a separate payment item. | |

| No. | Item | Unit | Description |
|--|---|------|--|
| Dewatering/Groundwater Control and Management | | | |
| 45 | a. Dewatering of Trenches | LS | Work item includes all design, labor, material and equipment associated with dewatering trench excavations required for completion of the work detailed and specified. This item includes all labor, materials and equipment required for discharge of water into the bedding and pipe zone material of completed segments of pipe as part of the overall groundwater management plan. |
| | b. Dewatering of Pump Station | LS | This item accounts for the all work associated with storage, management and testing of groundwater from dewatering of the pump station exaction. This item accounts for the cost of discharge of water determined from testing to meet drinking water standards for lead. |
| | c. Excess Water Management | LS | This item accounts for the all work associated with storage, management and testing of groundwater from dewatering of the trenches that could not be discharged into the bedding and pipe zone of completed segments. |
| | d. Lead Contaminated Water Disposal | GAL | Item accounts for the cost of hauling and disposal of water at a permitted facility found to be contaminated with lead. |
| 56 | Traffic Control Facilities and Traffic Control Plan | LS | Work includes the services of an engineer licensed in the State of Alabama to develop a Traffic Controls Facility and Traffic Control Plan in accordance with the requirements of Section 01 50 00. Provide equipment, materials and labor to provide traffic and pedestrian control to safely manage traffic through work zones. Measurement is lump sum for all traffic control work required and actually performed. Includes provision of labor, equipment and materials, signage, markings, barricades and cones, delivery, and installation for required traffic control practices and for removal or relocation of traffic control devices as needed. |
| Soil Management | | | |
| 67 | a. Hauling and Stockpiling | LS | Work item includes all labor, materials and equipment associated with storage and management and testing of excess soil from the work performed as part of this project. |
| | b. Testing | EA | Work item accounts for the cost of sampling and performance of lead testing on the stockpiled soil. |

| No. | Item | Unit | Description |
|-------------------------------------|--|------|---|
| | <u>c.</u> Disposal of Clean Soil | CY | Work item accounts for the cost of offsite disposal of soil that is tested to be clean and not contaminated with lead. |
| | <u>d.</u> Disposal of Contaminated Soil | CY | Work item accounts for the cost of disposal of soil at a permitted facility if found to be contaminated with lead. |
| <u>78</u> | Survey – Control and As Constructed Drawings | LS | Work item includes the services of a licensed surveyor for construction of the items and facilities detailed within these specifications and drawing and for the preparation of as-constructed drawings. |
| Erosion and Sediment Control | | | |
| <u>89</u> | a. Permit and CBMPP | LS | Work item includes the services of a QCP for the preparation of all documents and forms along with the CBMPP as required to obtain coverage for the work to be performed under ALR100000. This includes all fees as required by ADEM and local permitting agencies. |
| | b. Installation, Maintenance and Removal | LS | Work item includes the all labor, materials and equipment required for implementation, installation, monitoring and maintenance of the CBMPP along with removal of the BMPs after the site is fully stabilized. |
| <u>910</u> | Demolition | LS | Work item includes all labor, materials and equipment required for demolition/abandonment of the two existing pump stations, gravity sewers, force mains and manholes as detailed and specified. Item includes cost for removal and delivery of items to be salvaged to Jefferson County. |
| <u>101</u> | Manholes | EA | Work item includes all labor, materials and equipment required to install the detailed and specified manholes along the gravity sewers detailed to be installed as part of this project. |
| Final Site Restoration | | | |
| <u>112</u> | a. Grass | LS | Work item includes all labor, materials and equipment required for final site bed preparation, seeding, sodding and maintenance as required to stabilize and restore all areas disturbed in the completion of this project not to be paved or landscaped. |

| No. | Item | Unit | Description |
|-----|---|-----------|---|
| | b. Asphalt Pavement Outside of ALDOT ROW | SY | Work item includes all labor, materials and equipment required for asphalt paving of areas outside of the ROW of ALDOT. This includes milling and subgrade preparation as required and detailed. This item will not be used to pay for pavement damaged outside of the new force main and gravity sewer alignments. Contractor is responsible for the cost of pair of these damaged surfaces to the satisfaction of the owner. |
| | c. Asphalt Pavement within ALDOT ROW | SY | Work item includes all labor, materials and equipment required for asphalt paving of areas within the ROW of ALDOT. This includes milling and subgrade preparation as required and detailed. This item will not be used to pay for pavement damaged outside of the new force main and gravity sewer alignments. Contractor is responsible for the cost of pair of these damaged surfaces to the satisfaction of the owner. |
| | d. Graveled Surface Restoration | SY | Work item includes all labor, materials and equipment required for restoration of gravel surfaces along the alignment of the new sewer. |
| | e. Concrete Retaining Wall and Creek Bank Restoration | LS | Work item includes all labor, materials and equipment required to rebuild, restore the retaining wall along Dry Creek damaged during the installation of the gravity sewer and force main. This item includes all labor, materials and equipment to restore and stabilize the bank of the creek where disturbed during the completion of construction. |
| 12 | <u>Pump Station and Site Improvements</u> | <u>LS</u> | <u>Work item includes all labor, materials and equipment required for the construction of a submersible pump station and appurtenances, cast-in-place wet well and valve vault, electrical equipment and controls, generator, concrete retaining wall, concrete pavement, fencing, and clearing and removal of existing dumped materials and trash from the area where the pump station is to be constructed along with the upstream gravity sewer.</u> |
| 13 | <u>Equalization Tank and Pumping System</u> | <u>LS</u> | <u>Work item includes all labor, materials and equipment required for preparing the tank foundation, construction lining of the bolted steel tank, pumping system, piping and valves, and associated electrical and controls.</u> |
| 144 | Sanitary Sewer Flow Bypass Pumping/Flow Control | LS | Work item includes all labor, materials and equipment required for bypassing of main sewers and pump stations as required to install new main sewers and force mains. |

| No. | Item | Unit | Description |
|-----|--|------|--|
| 155 | Quality Control Testing by Contractor's Independent Testing Laboratory | LS | Work item includes all labor, material, equipment costs required for an Independent Testing Laboratory, to provide all quality control testing and sampling required in the plans and specifications including testing required under special inspection requirements. |
| 166 | Owner's Allowance | | Allowance for other work and services necessary to complete the project as specified herein. This allowance item shall only be used when directed in writing by the Owner. |

1.08 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by Owner.
6. Material remaining on hand after completion of Work.
7. Damaged material.

1.09 SCOPE OF PAYMENT

- A. The Contractor shall receive and accept compensation, as herein provided, as full payment for furnishing all labor, materials, tools, equipment, and incidentals; for performing all Work contemplated and embraced under the Contract; for all loss or damage arising out of the nature of the Work or from the action of the elements; for any unforeseen defects or obstructions which may arise during the prosecution of the Work and before its final acceptance by the Owner; for all risks connected with the prosecution of the Work; for all expenses incurred by or in consequence of suspension or discontinuance of such prosecution of the Work herein specified; for any infringement of patents, trademarks or copyrights; and for completing the Work in an acceptable manner according to the Drawings and Specifications.
- B. Payment for all Lump Sum Work shown or specified in Contract Documents is included in the Contract Price. Payment will be based on a percentage complete basis for each line item of the accepted Schedule of Values.
- C. Upon payment therefore, materials or work in place shall become the property of the Owner; however, the payment of any partial or periodical estimates prior to final acceptance of the Work by the Owner shall in no way constitute

an acknowledgment of the acceptance of the Work, in part or in total, nor in anyway prejudice or affect the obligation of the Contractor to repair, correct, renew or replace, at his expense, any defects or imperfections in the construction or in strength or quality of the materials used in the construction of the Work under the Contract.

- D. Final payment for Work governed by unit prices shall be made on the basis of the actual measurements and quantities accepted by the Engineer multiplied by the unit price for Work which is incorporated in or made necessary by the Contract.
- E. Final payment for Work governed by lump sum shall be made after the Engineer accepts the Work.
- F. Payment for this project will be by monthly payments, to be paid upon the Engineer's approval. A pay request will be submitted at the end of each month to the Engineer.

1.10 COMPENSATION FOR ALTERED QUANTITIES

- A. When the accepted quantities of Work vary from the quantities in the Proposal, the Contractor shall accept as payment in full, so far as Contract Items are concerned, payment at the original Contract price for the quantities of Work actually completed and accepted. No allowance shall be made for increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from his unbalanced allocation of overhead and profit among the Contract Items, or from any other cause.

1.11 PAYMENT FOR OMITTED ITEMS

- A. The Owner may, in the Owner's best interest, omit from the Work any Contract Item. Such omission of Contract Items shall not invalidate any other Contract provision or requirements. No claim for lost profit on deleted Work will be allowed.
- B. The Engineer shall have the right to omit from the Work any non-performed Contract Item which, in his opinion, is in the best interest of the Owner.
- C. Should a Contract Item be omitted or otherwise ordered not to be performed, the Contractor shall be paid for all Work performed toward completion of such item prior to the date of the order to omit such item. Payment for Work performed shall be as specified in this section.

- D. Should the Engineer omit or order nonperformance of a Contract Item or portion of such item from the Work, the Contractor shall accept payment in full at the Contract unit price for any Work actually completed and acceptable prior to the Engineer's order to omit or non-perform such Contract Item.
- E. Acceptable materials ordered by the Contractor or delivered on the Work prior to the date of the Engineer's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.
- F. In addition to the reimbursement provided in this section, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted Contract Item prior to the date of the Engineer's order. Such additional costs incurred by the Contractor must be directly related to the deleted Contract Item and shall be supported by certified statements by the Contractor as to the nature and amount of such costs.

1.12 CLAIMS FOR EXTRA WORK

- A. If the Contractor claims that any instructions by the Engineer or otherwise involve extra cost on his part, he shall give the Engineer written notice of said claim within 10 days after the receipt of such instructions, and in any event before proceeding to execute that portion of Work, stating clearly and in detail the basis of his claim or claims. No such claim shall be valid unless so made.
- B. Claims for additional compensation for extra Work, due to alleged errors in spot elevations, contour lines, or bench marks, will not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more Work than would reasonably be estimated from the Plans and topographical maps issued.
- C. Any discrepancies which may be discovered between actual conditions and those represented by the topographical maps and Plans shall be reported to the Engineer at once, and Work shall not proceed, except at the Contractor's risk, until written instructions have been received by the Contractor from the Engineer.
- D. If, on the basis of the available evidence, the Engineer determines that an adjustment of the contract price or time is justifiable, the procedure shall then be as provided in Section 01 28 00, Change Order Procedures.
- E. By execution of this Contract, the Contractor warrants that he has visited the site of the proposed Work and fully acquainted himself with the existing conditions relating to construction and labor, and that he fully understands the facilities, difficulties, and restrictions attending the execution of the Work under this Contract. The Contractor further warrants that he has thoroughly examined and is familiar with the Drawings, Specifications, and all other documents comprising the Contract. The Contractor further warrants that by

execution of this Contract, his failure when he was bidding on this Contract to receive or examine any form or document, or to visit the site and acquaint himself with existing conditions, in no way relieves him from any obligation under the Contract, and the Contractor agrees that the Owner shall be justified in rejecting any claim based on facts regarding which he should have been on notice as a result thereof.

1.13 PAYMENT FOR EXTRA WORK

- A. Should acceptable completion of the Contract require the performance of an item of Work for which no basis of payment has been provided in the original Contract or previously issued Change Orders, the same shall be called "Extra Work." Extra Work that is within the general scope of the Contract shall be covered by written Change Order. Change Orders for such Extra Work shall contain unit prices, lump sum, or time and material prices agreed upon through negotiation for performing the Work covered by the Change Order, in accordance with the requirements specified in the Change Order, and shall contain any adjustment to the Contract Time that, in the Owner's opinion, is necessary for completion of such Extra Work. The Contractor shall not perform any Work on a proposed Change Order until he receives written authorization from the Engineer.
- B. The Owner may at its discretion elect to perform the Extra Work with its own forces or to hire any such person, firm, partnership, or corporation to perform the Extra Work. Performance of the Extra Work by either of these methods shall not waive or invalidate any conditions or provisions of the Contract.
- C. Any claim for payment of Extra Work that is not covered by a Change Order shall be rejected by the Owner.
- D. Extra Work, approved by the Engineer and performed in accordance with these specifications shall be paid for at the Contract unit prices or agreed prices specified in the Change Order authorizing such Extra Work.
- E. When determined by the Engineer to be in the Owner's best interest, the Contractor may be ordered to proceed with Extra Work on the basis described below.
 - 1. Labor: For all labor (skilled and unskilled) and foremen in direct charge of a specific Extra Work item, the Contractor shall be reimbursed at the same rate of wage (or scale) being paid to such skilled and unskilled labor and foremen under the original Contract. Such wage or scale shall be agreed upon prior to beginning the Extra Work. The Contractor shall be reimbursed for the actual costs paid to, or on behalf of, workers by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits, or other benefits, when such amounts are required by collective bargaining agreement or other employment Contract generally applicable to the classes of labor employed on the Work.

2. Insurance and Taxes: For property damage, liability, and Workmen's Compensation Insurance premiums, unemployment insurance contributions, and social security taxes on the Extra Work, the Contractor shall be reimbursed at the actual cost. The Contractor shall furnish satisfactory evidence of the rate or rates paid for such insurance and taxes.
3. Materials: For materials installed and accepted by the Engineer, the Contractor shall receive the actual cost of such materials, including transportation charges paid by him (exclusive of machinery rentals as hereinafter set forth).
4. Equipment: For any machinery or special equipment (other than small tools) including fuel and lubricants, plus transportation costs, the use of which has been authorized by the Engineer, the Contractor shall be reimbursed at the rental rates agreed upon in writing before such work is begun for the actual time that such equipment is committed to the Work and necessary for the actual prosecution of the Work.
5. Miscellaneous: No additional reimbursement will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.
6. Overhead and Profit: 15 percent shall be added to the actual reimbursable cost, as enumerated above, for overhead and profit. The Contractor shall be entitled to 8 percent of subcontractors' costs to defer cost of insurance, supervision, and management. The subcontractors shall be entitled to actual cost of performing the Extra Work plus 15 percent of actual cost to cover supervision, overhead, bond, and profit. The Contractor shall submit to the Owner itemized cost sheets showing actual cost of performance of the Work. Actual costs are defined as follows:
 - a. Labor costs, including time of foremen while engaged directly on the Extra Work.
 - b. Labor Insurance and Workmen's Benefits.
 - c. Social Security and unemployment contributions.
 - d. Ownership or rental costs of construction equipment used in the actual prosecution of the Extra Work. Such costs shall not exceed those listed in the latest publication of the Rental Rate Blue Book for Construction Equipment published by PRIMEDIA Information Incorporated or rental rates prevailing in the area of the Work. Charges for equipment already allocated to the project shall be based upon standard or prevailing monthly rental rates. Rental rates or use rates shall not be charged for equipment having a value of \$200.00 or less, since equipment and tools of the lesser value stated are considered to be "small tools", and as such, are considered to be part of overhead.

- e. Costs of materials and/or equipment entering permanently into the Work.
 - f. Costs of power and consumable supplies for the operation of power equipment where such costs are not included in rental rates or use charges.
7. Comparison of Records: The Contractor and the Engineer shall compare records of the cost of Extra Work at the end of each day. Agreement shall be indicated by signature of the Contractor and Engineer or their daily authorized representatives.
8. Statement: No payment will be made for Extra Work performed until the Contractor has furnished the Engineer with duplicate itemized statements of the cost of such work detailed as follows:
- a. Name, classification, date, daily hours, total hours, rate, and extension for each laborer and foreman.
 - b. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.
 - c. Quantities of materials, prices, and extensions.
 - d. Transportation of materials.
 - e. Cost of property damage, liability and Workmen's Compensation Insurance premiums, unemployment insurance contributions, and Social Security tax.
 - f. Statements shall be accompanied and supported by receipted invoices for all materials used and transportation charges. However, if materials used on the Extra Work are not specifically purchased for such Work but are taken from the Contractor's stock, then in lieu of the invoices, the Contractor shall furnish an affidavit certifying that such materials were taken from his stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the Contractor.
 - g. Payment for overhead and profit based on the percentages specified above, shall constitute full compensation for all items of expense incurred but not specifically detailed for the Extra Work. The total payment made as described above shall constitute full compensation for such Work.

1.14 PARTIAL PAYMENTS (ESTIMATES)

- A. At the end of each calendar month during the life of the Contract, the Contractor will prepare an estimate of the quantities of Work and of the total amount due therefore. Upon acceptance of the estimate by the Contractor and the Engineer, a partial payment will be made to the Contractor equivalent in amount to the value of all Work done to the end of the preceding month, less the percent of such amount to be retained as specified in this section, less previous payment.

1.15 RETAINAGE

- A. In making partial payments, the Owner shall retain 5 percent of the estimated value of Work done including the value of materials stored on the Site until 50 percent completion of the Work has been accomplished. No additional retainage will be withheld after 50 percent completion.
- B. The Contractor may request that the Owner accept a Certificate of Deposit (CD) issued in the joint names of the Owner and the Contractor in place of retainage. The CD shall be conditionally assigned by the Contractor to the Owner. CD's shall be issued in increments of \$10,000 minimum by a federally insured Bank or Savings and Loan Association in Jefferson County. The issuer of certificates shall not cash the CD without written approval of the Owner. Interest will be retained with the CD and all subsequent renewals. The Contractor shall be required to request the acceptance of the CD in place of retainage and upon approval shall receive specific instructions from the Owner regarding procedures to be followed.
- C. The Contractor agrees that he will indemnify and save the Owner harmless from all claims arising out of the lawful demands of subcontractors, laborers, workmen, mechanics, and suppliers of machinery, parts, equipment, power tools, fuel, materials and other construction items, incurred in the performance of Work under this Contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature herein above described have been paid, discharged, or waived. If the Contractor should fail to do so, then the Owner may, after having served written notice on the Contractor, either directly pay those unpaid bills for which the Owner has received written notice, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is presented that all such liabilities have been fully discharged, whereupon payment to the Contractor shall be resumed in accordance with the terms of this Contract, but, in no event, shall the provisions of this article be construed to impress upon the Owner any obligations to either the Contractor or his Surety. In paying any unpaid bills of the Contractor the Owner shall be deemed to be the temporary agent of the Contractor for this specified purpose; and any payment so made by the Owner shall be considered as a payment made under the Contract by the Owner to the Contractor, and the Owner shall not be liable to the Contractor for any such payments made in good faith.

1.16 PAYMENT FOR MATERIALS STORED

- A. Unless stated otherwise in the Special Conditions, partial payments may be made to the extent of the delivered cost of materials to be incorporated into the Work, provided that such materials meet the requirements of the Contract, Plans, and Specifications, are listed in the Bid Proposal Form, and are delivered to acceptable locations of the Work site or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:
1. The material has been stored or stockpiled in a manner acceptable to the Engineer at or on an approved site.
 2. The Contractor has furnished the Engineer with acceptable evidence of the quantity and quality of such stored or stockpiled materials.
 3. The Contractor has furnished the Owner evidence that the material so stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the Work.
- B. On the first estimate following the estimate for which the Contractor has been paid for materials stored, the Contractor must show evidence, in the form of a certified paid invoice that he has paid the supplier for the materials; otherwise the amount of material costs previously paid shall be deducted from the current estimate.
- C. It is understood and agreed that the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of his responsibility for furnishing and placing such materials in accordance with the requirements of the Contract, Plans, and Specifications.
- D. In no case will the amount of partial payments for materials on hand exceed the Contract price for such materials or the Contract price for the Contract Item in which the material is intended to be used.
- E. No partial payment will be made for stored or stockpiled living or perishable plant materials.
- F. The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this section.

1.17 FINAL PAYMENT

- A. When the Work provided for by the Contract has been completely performed on the part of the Contractor and all parts of the Work have been approved by the Engineer and accepted by the Owner, a final estimate will be prepared which shows the total cost of the Work performed under the Contract, including Extra Work as authorized by Change Orders, the total amount retained and the total amount paid on previous partial estimates. All prior estimates upon which payments have been made are subject to necessary corrections or revisions in the final payment. All pay estimates will be certified as correct by the Engineer and approved by the Owner before payment.
- B. With the final application for payment the original, notarized, legal affidavit of Notice of Completion shall be provided.
 - 1. Contractor shall advertise in the Birmingham New unless otherwise approved for a period of period of four successive weeks.
 - 2. Text within the affidavit shall be as follows unless otherwise notified.

Notice of Completion

In accordance with Chapter I, Title 39, Code of Alabama 1975, notice is hereby given that (INSERT CONTACTOR NAME), Contractor, has completed the Contract for Jefferson County Commission, the Owner, and has made request for final settlement of said Contract know as Leeds Parkway Drive Sanitary Sewer Overflow Elimination Project generally located within the City of Leeds, AL. All persons having any claim for labor, materials or otherwise in connection with this project should immediately notify Brian Rohling, PE, Jefferson County Commission, Environmental Services Department, Suite A-300, 716 Richard Arrington Jr. Blvd North, Birmingham, Alabama 35203, Telephone (205) 214-8611.

- C. The final payment will be made to the Contractor as soon as practicable after final acceptance by the Owner.
- D. Advertisement of completion shall be done in accordance with requirements of Section 01 77 00, Closeout Procedures.

1.18 CLAIMS FOR ADJUSTMENT AND DISPUTES

- A. If for any reason the Contractor deems that additional compensation is due him for Work or materials not clearly provided for in the Contract, Plans, or Specifications or previously authorized Extra Work, he shall notify the Engineer, in writing, of his intention to claim such additional compensation before he begins the Work on which he bases the claim. The Engineer will then make such recommendations, as he sees fit, regarding the validity of the

claim, to the Owner. It is expressly understood that the Owner shall be the governing body on the validity of any and all claims. No Work is to be done without prior written approval of the Engineer. If such notification is not given or the Engineer is not afforded proper opportunity by the Contractor for keeping strict account of actual costs required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the Engineer has kept account of the cost of the Work shall not in any way be construed as proving or substantiating the validity of the claim. When the Work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit his written claim to the Engineer, who will present it to the Owner for consideration in accordance with local laws or ordinances.

- B. Nothing in this section shall be construed as a waiver of the Contractor's right to dispute final payment based on differences in measurements or computations.

1.19 PROHIBITED INTEREST

- A. No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction, or material supply Contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract or in any part thereof. No officer, employee, architect, attorney, engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the Project.

1.20 BUY AMERICAN CLAUSE

- A. The Contractor agrees that preference will be given to United States domestically produced materials and equipment by the Contractor, subcontractors, material men, and suppliers in the performance of this Contract.
- B. The Contractor shall obtain, prior to construction, approval in writing from the Owner for any non-domestic materials to be incorporated in the Work.

1.21 DEFECT ASSESSMENT

- A. The Contractor shall replace the Work, or portions of the Work, not conforming to specified requirements.

- B. If in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct one of the following remedies:
1. The defective Work may remain, but the unit price/sum will be adjusted to a new price/sum at the discretion of the Engineer.
 2. The defective Work will be partially repaired to the instructions of the Engineer, and the unit price/sum will be adjusted to a new price/sum at the discretion of the Engineer.
 3. The individual specification sections may modify these options or may identify a specific formula or percentage price/sum reduction.

1.22 NON-PAYMENT FOR REJECTED PRODUCTS

- A. Payment will not be made for any of the following:
1. Products wasted or disposed of in a manner that is not acceptable.
 2. Products determined as unacceptable before or after placement.
 3. Products not completely unloaded from the transporting vehicle.
 4. Products placed beyond the lines and levels of the required Work.
 5. Products remaining on hand after completion of the Work.
 6. Loading, hauling, and disposing of rejected products.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 31 13
PROJECT COORDINATION**

PART 1 GENERAL

1.01 RELATED WORK AT SITE

A. General:

1. Other work that is either directly or indirectly related to scheduled performance of the Work under these Contract Documents, listed henceforth, is anticipated to be performed at Site by others.
2. Coordinate the Work of these Contract Documents with work of others as specified in General Conditions.
3. Include sequencing constraints specified herein as a part of Progress Schedule.
4. For the railroad trenchless crossing, Contractor shall comply with requirements of the license agreement included in Appendix F.
5. Contractor shall comply with the conditions of the Army Corps of Engineers permit included in Appendix G.
6. Contractor shall comply with the requirements of the ALDOT permit included in Appendix H.
 - a. ALDOT plans to repave Dunnivant Road (SR-25). Contractor shall coordinate with ALDOT to ensure this section of road is only repaved once.
- ~~6.7.~~ Contractor shall comply with the Right-of-Way Special Promises/Agreements included in Appendix I.

1.02 UTILITY NOTIFICATION AND COORDINATION

- A. Coordinate the Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during Work.
- B. Prior to the start of any work contact, the Leeds Water Works Board for water line locates. 811 will not locate their water lines. Point of Contact, Mr. Bill Morris, Office 205.699.5151; Cell 205.966.0940. Coordinate with the Water Works for installation of a 3/4-inch water meter for the pump station. Pay all costs associated with the meter and connection to the water main within the street. Construction Sequence Requirements
- C. Excavation of the pump station site along with the sections that parallel Dry Creek shall be performed during typical dry periods of the year (August to October) to minimize the volume of groundwater that must be managed.

D. All tree clearing shall be completed between November 1 and March 31. Areas cleared shall be stabilized in accordance with the CBMPP.

E. Contractor shall coordinate with ALDOT regarding paving coordination for the 500-foot section on Dunnivant Road currently to be repaved by ALDOT. Contractor shall coordinate with ALDOT paving so this section is only paved once.

1.03 FACILITY OPERATIONS

- A. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption flow.
- B. When necessary, plan, design, and provide various temporary services, utilities, connections, temporary piping and bypass pumps to maintain continuous operations of Owner's facility.
- C. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by Owner and Engineer. Such authorization will be considered within 48 hours after receipt of Contractor's written request.
- D. Do not proceed with Work affecting a facility's operation without obtaining Owner's and Engineer's advance approval of the need for and duration of such Work.

1.04 ADJACENT FACILITIES AND PROPERTIES

- A. Examination:
 - 1. After Effective Date of the Agreement and before Work at Site is started, Contractor, Engineer, and affected property owners and utility owners shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.
 - 2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.
- B. Documentation:
 - 1. Record and submit documentation of observations made on examination inspections in accordance with paragraph Construction Photographs.
 - 2. Upon receipt, Engineer will review, sign, and return one record copy of documentation to Contractor to be kept on file in field office.

3. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Contractor's operations, and is for the protection of adjacent property owners, Contractor, and Owner.

1.05 CONSTRUCTION PHOTOGRAPHS

- A. Photographically document all phases of the project including preconstruction, construction progress, and post-construction.
- B. Engineer shall have the right to select the subject matter and vantage point from which photographs are to be taken.
- C. Preconstruction and Post-Construction:
 1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take a sufficient photographs to fully document pipe alignment and property adjacent to the alignment. In addition, the full alignment shall be digitally video recorded.
 2. Particular emphasis shall be directed to structures both inside and outside the site, pavement and landscaping.
 3. Format:
 - a. Digital pictures minimum resolution of 5 mega pixels.
 - b. Videos shall be recorded in high definition.
- D. Construction Progress Photos:
 1. Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.
 2. Weekly: Take 48 exposures using Digital, minimum resolution of 5 mega pixels.
- E. Digital Images:
 1. Archive using a commercially available photo management system.
 2. Label each disk with Project and Owner's name, and week and year images were produced.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CUTTING, FITTING, AND PATCHING

- A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.

- B. Obtain prior written authorization of Engineer before commencing Work to cut or otherwise alter:
 - 1. Structural or reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
 - 2. Weather- or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Work of others.

- C. Refinish surfaces to provide an even finish.
 - 1. Refinish continuous surfaces to nearest intersection.
 - 2. Refinish entire assemblies.
 - 3. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and Work is evident in finished surfaces.

- D. Restore existing work, Underground Facilities, and surfaces that are to remain in completed Work.

- E. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.

- F. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and fill voids.

- G. Remove specimens of installed Work for testing when requested by Engineer.

END OF SECTION

SECTION 01 45 33
SPECIAL INSPECTION, OBSERVATION, AND TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. This section covers requirements for Special Inspection, Observation, and Testing required in accordance with Chapter 17 of the 2015 IBC and is in addition to any supplemental requirements included in Statement of Special Inspections shown in supplement located at end of this section.

1.02 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
 2. International Code Council (ICC):
 - a. International Building Code (IBC).
 - b. Evaluation Service (ICC-ES) Reports and Legacy Reports.

1.03 DEFINITIONS

- A. Agencies and Personnel:
1. Agency Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.
 2. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.
 3. Registered Design Professional in Responsible Charge: An individual who is registered or licensed to practice their respective design profession as defined by statutory requirements of professional registration laws of state or jurisdiction in which Project is to be constructed.
 4. Special Inspector: Qualified person employed by Owner who will demonstrate competence to the satisfaction of AHJ for inspection of a particular type of construction or operation requiring Special Inspection.

- B. Statement of Special Inspections: Detailed written procedure contained on Drawings establishing systems and components subject to Special Inspection, Observation, and Testing during construction, type and frequency of testing, extent and duration of Special Inspection, and reports to be completed and distributed by Special Inspector.

- C. Special Inspection:
 - 1. Special Inspection: Inspection required of materials, installation, fabrication, erection, or placement of components and connections requiring special expertise to ensure compliance with approved Contract Documents and referenced standards.
 - 2. Special Inspection, Continuous: Full-time observation of work requiring Special Inspection by an approved Special Inspector who is present in area where the Work is being performed.
 - 3. Special Inspection, Periodic: Part-time or intermittent observation of the Work requiring Special Inspection by an approved Special Inspector who is present in area where the Work has been or is being performed, and at completion of the Work.

- D. Structural Systems and Components:
 - 1. Diaphragm: Component of structural lateral load resisting system consisting of roof, floor, or other membrane or bracing system acting to transfer lateral forces to vertical resisting elements of structure.
 - 2. Drag Strut or Collector: Component of structural lateral load resisting system consisting of diaphragm or shear wall element that collects and transfers diaphragm shear forces to vertical force-resisting elements or distributes forces within diaphragm or shear wall.
 - 3. Seismic-Force-Resisting System: That part of structural lateral load resisting system that has been considered in the design to provide required resistance to seismic forces identified on Drawings.
 - 4. Shear Wall: Component of structural lateral load resisting system consisting of a wall designed to resist lateral forces parallel to plane of the wall. Unless noted otherwise on Drawings, load-bearing walls with direct in-plane connections to roof and floors shall be considered to be shear walls.
 - 5. Wind Force Resisting System: That part of the structural system that has been considered in the design to provide required resistance to wind forces identified on Drawings.

- E. Nonstructural Components:
 - 1. Architectural Component Supports: Structural members or assemblies of members which transmit loads and forces from architectural systems or components to structure, including braces, frames, struts, and attachments.

2. Electrical Component Supports: Structural members or assemblies which transmit loads and forces from electrical equipment to structure, including braces, frames, legs, pedestals, and tethers, as well as elements forged or cast as part of component for anchorage.
3. Mechanical Component Supports: Structural members or assemblies which transmit loads and forces from mechanical equipment to structure, including braces, frames, skirts, legs, saddles, pedestals, snubbers, and tethers, as well as elements forged or cast as part of component for anchorage.

F. Professional Observation:

1. Does not include or waive responsibility for required Special Inspection or inspections by building official.
2. Requirements are indicated on Statement of Special Inspections provided in supplement located at the end of this section.
3. Geotechnical Observation: Visual observation of selected subgrade bearing surfaces and installation of deep foundation elements by a registered design professional for general conformance to Contract Documents.
4. Structural Observation: Visual observation of structural system(s) by a registered design professional for general conformance to Contract Documents.

1.04 STATEMENT OF SPECIAL INSPECTIONS REQUIREMENTS

A. Designated Systems for Inspection:

1. Seismic-force-resisting systems designated under IBC Section 1705 and subject to Special Inspection under Section 1705: None required.
2. Wind-force-resisting systems designated under IBC Section 1705: None required.
3. Architectural, Mechanical, and Electrical Components subject to Special Inspection under IBC Section 1705.12.5 and 1705.12.6 for Seismic Resistance: None required.

B. Statement of Special Inspections:

1. As included in supplement located at the end of this section and in support of building permit application, Project-specific requirements were prepared by Registered Design Professional in Responsible Charge. The following identifies elements of inspection, observation, and testing program to be followed in construction of the Work:
 - a. Special Inspection and testing required by IBC Section 1705 and other applicable sections and referenced standards therein.
 - b. Type and frequency of Special Inspection required.

- c. Type and frequency of testing required.
 - d. Required frequency and distribution of testing and Special Inspection reports to be distributed by Special Inspector to Engineer, Contractor, building official, and Owner.
 - e. Geotechnical Observation to be Performed: Required frequency and distribution of Geotechnical Observation reports by registered design professional to Contractor, building official, and Owner.
 - f. Structural Observations to be Performed: Not required for this Project.
- C. Special Inspection and associated testing of shop fabrication and field construction will be performed by an approved accredited independent agency or by Authority Having Jurisdiction's (AHJ) approved, qualified inspection staff. Owner will secure and pay for services of agency to perform Special Inspection and associated testing.
- D. Code required Special Inspection with associated testing and Professional Observation, as provided in Statement of Special Inspections in supplement located at the end of this section and further provided in this section, is for benefit of Owner and does not:
- 1. Relieve Contractor of responsibility for providing adequate quality control measures.
 - 2. Relieve Contractor of responsibility for damage to or loss of material before acceptance.
 - 3. Constitute or imply acceptance.
 - 4. Affect continuing rights of Owner after acceptance of completed Work.
- E. The presence or absence of code required Special Inspector and Professional Observer does not relieve Contractor from Contract requirements.
- F. Contractor is responsible for additional costs associated with Special Inspection and Testing and Observation when Work is not ready at time identified by Contractor and Special Inspectors and Professional Observer are onsite, but not able to provide contracted services.
- G. Contractor is responsible for associated costs for additional Special Inspection and Testing and Professional Observation by Special Inspectors and Professional Observers required because of rejection of materials of in place Work that cannot be made compliant to Contract Document without additional inspections and observation and testing.

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION**

3.01 GENERAL

- A. Requirements of the Statement of Special Inspections are provided by the Owner. All other testing and inspections, unless noted otherwise, are provided by Contractor.
- B. Provide access to shop or Site for Special Inspection and Testing and Professional Observation requirements.
- C. Notify Engineer in advance of required Special Inspection and Professional Observation no later than 48 hours prior to date of Special Inspection and Professional Observation.
- D. Provide access for Special Inspector to construction documents.
- E. Retain special inspection records on-site to be readily available for review.
- F. Cooperate with Special Inspector and provide safe access to the Work to be inspected.
- G. Submit Fabricator's Certificates of Compliance for approved fabricators.
- H. Provide reasonable auxiliary services as requested by the Special Inspector. Auxiliary services required include, but not limited to:
 - 1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests to assist the Special Inspector in performing test/inspections.
 - 2. Providing storage space for the Special Inspector's exclusive use, such as for storing and curing concrete test samples and delivery of samples to testing laboratories.
 - 3. Providing the Special Inspector with access to all approved submittals.
 - 4. Providing security and protection of samples and test equipment at the Project Site.
 - 5. Provide samples of materials to be tested in required quantities.
- I. Materials and systems shall be inspected during placement where Continuous Special Inspection is required.
- J. Where Periodic Special Inspection is indicated in the Statement of Special Inspections:
 - 1. Schedule inspections for either during or at completion of their placement or a combination of both.

2. Schedule periodically inspected Work (either inspected during or after its placement) so that corrections can be completed and re-inspected before Work is inaccessible.
3. Sampling a portion of the Work is not allowed. Schedules shall provide for inspection of all Work requiring periodic inspection.

3.02 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this specification:

1. Statement of Special Inspections.
 - a. Table 1: Required Non-Structural Special Inspection.
 - b. Table 2: Required Structural Special Inspection.
 - c. Table 3: Testing for Required Special Inspection.
 - d. Table 4: Required Special Inspection for Seismic Resistance for Structural Systems.
 - e. Table 5: Required Special Inspection for Wind Resistance for Structural Systems.
 - f. Table 6: Testing for Seismic Resistance.

END OF SECTION

STATEMENT OF SPECIAL INSPECTIONS

GENERAL NOTES

1. THE STATEMENT OF SPECIAL INSPECTIONS PROVIDE PROJECT COMPLIANCE WITH THE PROVISIONS OF THE 2015 INTERNATIONAL BUILDING CODE (IBC) CHAPTER 17 FOR SPECIAL INSPECTION, STRUCTURAL OBSERVATION, AND TESTING FOR WIND AND SEISMIC RESISTANCE AS APPLICABLE. EXCEPT WHERE OTHERWISE NOTED, THIS INSPECTION IS OWNER FURNISHED.
2. STANDARD SPECIAL INSPECTION REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS ARE CONTAINED IN TABLE 1.
3. STANDARD SPECIAL INSPECTION REQUIREMENTS FOR STRUCTURAL COMPONENTS, REGARDLESS OF WIND OR SEISMIC DESIGN CATEGORIES, ARE CONTAINED IN TABLE 2. STANDARD TESTING REQUIREMENTS FOR STRUCTURAL COMPONENTS ARE CONTAINED IN TABLE 3.
4. PROJECT SPECIFIC REQUIREMENTS FOR STRUCTURES ASSIGNED TO SEISMIC DESIGN CATEGORIES C, D, E, OR F ARE CONTAINED IN TABLE 4. ADDITIONAL TESTING REQUIREMENTS FOR STRUCTURAL RESISTANCE ARE CONTAINED IN TABLE 6.
5. PROJECT SPECIFIC REQUIREMENTS FOR STRUCTURES SUBJECT TO BASIC WIND SPEEDS $[(V_{asd})]$ IN EXCESS OF 110 MPH ARE CONTAINED IN TABLE 5.
6. FOR ADDITIONAL REQUIREMENTS, REFER TO SPECIFICATION SECTION 01 45 33, SPECIAL INSPECTION, OBSERVATION, AND TESTING. THESE INCLUDE:
 - A. CONTRACTOR'S REQUIREMENTS TO PROVIDE ACCESS TO THE WORK FOR REQUIRED INSPECTIONS, AND TO PROVIDE NOTICE OF REQUIRED INSPECTIONS AND STRUCTURAL OBSERVATION.
 - B. DEFINITIONS AND TERMINOLOGY USED IN THIS STATEMENT OF SPECIAL INSPECTIONS.

SPECIAL INSPECTION

1. SPECIAL INSPECTION WILL BE IN ACCORDANCE WITH IBC SECTIONS 1704 AND 1705 TOGETHER WITH LOCAL AND STATE AMENDMENTS. REFER TO THE FOLLOWING TABLES FOR PROJECT SPECIFIC INSPECTION TYPES AND FREQUENCIES.
2. SPECIAL INSPECTIONS WILL BE PROVIDED BY A CERTIFIED OR QUALIFIED INSPECTOR AND ASSOCIATED TESTING WILL BE PERFORMED BY AN APPROVED ACCREDITED INDEPENDENT AGENCY. THE ~~OWNER~~ **OWNER** WILL SECURE AND PAY FOR THE SERVICES OF THE AGENCY TO PERFORM ALL SPECIAL INSPECTION AND CONTRACTOR WILL SECURE AND PAY FOR THE SERVICES OF AN INDEPENDENT AGENCY TO PERFORM ASSOCIATED

TESTS. INSPECTORS FOR EACH SYSTEM AND MATERIAL WILL BE INTERNATIONAL CODE COUNCIL (ICC) CERTIFIED OR OTHERWISE APPROVED BY THE BUILDING OFFICIAL.

3. THE SPECIAL INSPECTOR WILL OBSERVE THE INDICATED WORK FOR COMPLIANCE WITH THE APPROVED CONTRACT DOCUMENTS AND SUBMIT RECORDS OF INSPECTION. ALL DISCREPANCIES WILL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CONTRACTOR FOR CORRECTION.
4. SPECIAL INSPECTION AND ASSOCIATED TESTING REPORTS WILL BE SUBMITTED TO THE ENGINEER, CONTRACTOR, BUILDING OFFICIAL, AND OWNER WITHIN ONE WEEK OF INSPECTION OR WITHIN ONE WEEK OF TEST COMPLETION. INSPECTIONS FOR WHICH REPORTING WILL BE REQUIRED ARE NOTED IN THE FOLLOWING TABLES.
5. AT THE CONCLUSION OF CONSTRUCTION, A FINAL REPORT DOCUMENTING REQUIRED SPECIAL INSPECTIONS AND CORRECTION OF PREVIOUSLY NOTED DISCREPANCIES WILL BE SUBMITTED.

GEOTECHNICAL OBSERVATION

1. ALL FOUNDATION BEARING SURFACES SHALL BE INSPECTED BY GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF REINFORCING STEEL. ADDITIONAL SPECIAL INSPECTION REQUIREMENTS ARE LISTED IN TABLE 1.
2. GEOTECHNICAL TESTING REQUIREMENTS ARE LISTED IN TABLE 3.

STRUCTURAL OBSERVATION

1. STRUCTURAL OBSERVATION IN ACCORDANCE WITH IBC SECTION 1704.6 TOGETHER WITH LOCAL AND STATE AMENDMENTS IS NOT REQUIRED FOR THIS PROJECT.

SPECIAL INSPECTIONS FOR WIND RESISTANCE

1. SPECIAL INSPECTIONS REQUIREMENTS FOR WIND RESISTANCE IN ACCORDANCE WITH IBC SECTION 1705.11 2015 ARE NOT APPLICABLE TO THIS PROJECT.

SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

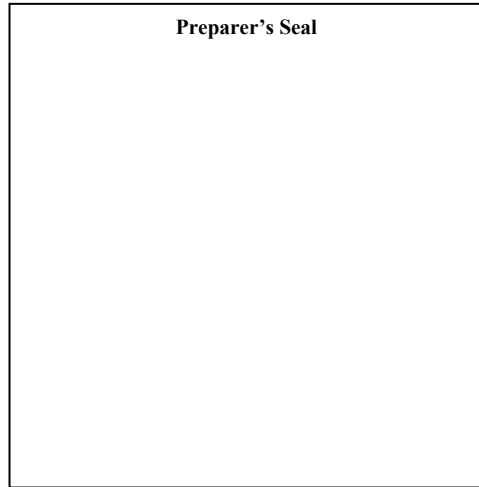
1. SPECIAL INSPECTIONS REQUIREMENTS FOR SEISMIC RESISTANCE IN ACCORDANCE WITH IBC SECTION 1705.12 AND 1705.13 ARE NOT APPLICABLE TO THIS PROJECT.

Statement of Special Inspections Prepared by:

Type or Print Name

Signature

Date



| <p align="center">TABLE 1 REQUIRED NON-STRUCTURAL SPECIAL INSPECTION REFER TO SPECIFICATION SECTION 01 45 33</p> | | | | | | |
|---|------------------------------------|--|--|---|--------------------------------------|---|
| SYSTEM OR MATERIAL | 2015 IBC CODE REFERENCE | REFERENCED STANDARD | PERIODIC OWNER FURNISHED SPECIAL INSPECTION (SEE NOTE 1) | CONTINUOUS OWNER FURNISHED SPECIAL INSPECTION | COMMENTS | TESTING FOR SPECIAL INSPECTION |
| GEOTECHNICAL | | | | | | |
| 1. SOILS: | | | | | | |
| A. VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY | 1705.6, 1803.5.8, 1803.5.9, 1804.5 | SECTION 31 23 13, SUBGRADE PREPARATION | X | | OBSERVATION BY PROFESSIONAL ENGINEER | |
| B. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL | 1705.6 | SECTION 31 23 16, EXCAVATION | X | | OBSERVATION BY PROFESSIONAL ENGINEER | |
| C. PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS | 1705.6 | SECTION 31 23 23, FILL AND BACKFILL | X | | | SEE TABLE 3 FOR GRADATION TEST REQUIREMENTS |
| D. VERIFY USE OF PROPER MATERIALS, DENSITIES, AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF COMPACTED FILL | 1705.6, 1803.5.8 | SECTION 31 23 23, FILL AND BACKFILL | | X | | SEE TABLE 3 FOR DENSITY TEST REQUIREMENTS |
| E. PRIOR TO PLACEMENT OF COMPACTED FILL, OBSERVE SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY | 1705.6 | SECTION 31 23 13, SUBGRADE PREPARATION | X | | OBSERVATION BY PROFESSIONAL ENGINEER | SEE TABLE 3 FOR DENSITY TEST REQUIREMENTS |

| TABLE 1 REQUIRED NON-STRUCTURAL SPECIAL INSPECTION REFER TO SPECIFICATION SECTION 01 45 33 | | | | | | |
|---|-------------------------------|---------------------------------|---|---|----------|--------------------------------------|
| SYSTEM OR MATERIAL | 2015 IBC CODE REFERENCE | REFERENCED STANDARD | PERIODIC OWNER FURNISHED SPECIAL INSPECTION (SEE NOTE 1) | CONTINUOUS OWNER FURNISHED SPECIAL INSPECTION | COMMENTS | TESTING FOR SPECIAL INSPECTION |
| GENERAL | | | | | | |
| 1. INSTALLATION OF MATERIALS THAT REQUIRE ADDITIONAL MANUFACTURER'S INSTRUCTIONS BEYOND CODE REQUIREMENTS | 1703.4.2, 1705.1.1 ITEM 3 | ICC-ES EVALUATION REPORTS | | X | | |
| STRUCTURAL | | | | | | |
| SEE TABLE 2. | | | | | | |

NOTES:

1. PERIODIC INSPECTION IS DEFINED AS INSPECTION BY THE SPECIAL INSPECTOR OF ALL MATERIALS AND SYSTEMS, IN SOME CASES PERFORMED DURING THEIR PLACEMENT AND IN ALL CASES PERFORMED UPON COMPLETION OF THEIR PLACEMENT. THE COMPLETION INSPECTION SHALL BE PERFORMED SO THAT WORK CAN BE CORRECTED PRIOR TO OTHER RELATED WORK PROCEEDING AND COVERING INSPECTED WORK.

| <p align="center">TABLE 2 REQUIRED STRUCTURAL SPECIAL INSPECTION REFER TO SPECIFICATION SECTION 01 45 33</p> | | | | | | |
|--|-------------------------------|--|--|---|---|--|
| SYSTEM | 2015 IBC CODE REFERENCE | REFERENCED STANDARD | PERIODIC OWNER FURNISHED SPECIAL INSPECTION (SEE NOTE 1) | CONTINUOUS OWNER FURNISHED SPECIAL INSPECTION | COMMENTS | TESTING FOR SPECIAL INSPECTION |
| CONCRETE | | | | | | |
| 1. INSPECTION OF REINFORCING STEEL | 1908.4 | ACI 318: 20, 25.2, 25.3, 26.5.1-26.5.3 | X | | | |
| 2. INSPECTION OF ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS | | ACI 318: 17.8.2, 17.8.2.4 ICC-ES EVALUATION REPORTS | X | | PROVIDE CONTINUOUS SPECIAL INSPECTION FOR ADHESIVE ANCHORS DESIGNED TO RESIST SUSTAINED TENSION LOADS AND WHERE REQUIRED BY ICC-ES REPORT | |
| 3. VERIFYING USE OF REQUIRED DESIGN MIX | 1904.1,1904.2, 1908.2, 1908.3 | ACI 318: Ch.19, 26.4.3, 26.4.4 | X | | | |
| 4. AT THE TIME FRESH CONCRETE IS SAMPLED TO FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE | 1908.1 | ASTM C 172, ASTM C 31, ACI 318: 26.4.5, 26.12 | | X | | SEE TABLE 3 FOR CONCRETE TEST REQUIREMENTS |
| 5. INSPECTION FOR MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES | 1908.9 | ACI 318: 26.4.7-26.4.9 | X | | | |

| TABLE 2 REQUIRED STRUCTURAL SPECIAL INSPECTION REFER TO SPECIFICATION SECTION 01 45 33 | | | | | | |
|--|-------------------------------|------------------------|---|---|----------|--------------------------------------|
| SYSTEM | 2015 IBC CODE REFERENCE | REFERENCED STANDARD | PERIODIC OWNER FURNISHED SPECIAL INSPECTION (SEE NOTE 1) | CONTINUOUS OWNER FURNISHED SPECIAL INSPECTION | COMMENTS | TESTING FOR SPECIAL INSPECTION |
| CONCRETE | | | | | | |
| 6. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED | 1705.3 | ACI 318: 26.10.1(b) | X | | | |
| 7. INSPECTION OF WATERSTOPS FOR PROPER SHAPE, LOCATION, JOINT QUALITY, AND SURROUNDING CONCRETE PLACEMENT | | | X | | | |

NOTES:

1. PERIODIC INSPECTION IS DEFINED AS INSPECTION BY THE SPECIAL INSPECTOR OF ALL MATERIALS AND SYSTEMS, IN SOME CASES PERFORMED DURING THEIR PLACEMENT AND IN ALL CASES PERFORMED UPON COMPLETION OF THEIR PLACEMENT. THE COMPLETION INSPECTION SHALL BE PERFORMED SO THAT WORK CAN BE CORRECTED PRIOR TO OTHER RELATED WORK PROCEEDING AND COVERING INSPECTED WORK.

2. VISUAL INSPECTION IS THE RESPONSIBILITY OF THE CONTRACTOR'S WELDING INSPECTOR(S) AND IS NOT CONSIDERED SPECIAL INSPECTION. CONTRACTOR MUST PROVIDE A QUALIFIED WELDING INSPECTOR TO OVERSEE CONTRACTOR'S WELDING OPERATIONS, AS REQUIRED BY AWS D1.1, SECTIONS 6.1.2 & 6.6, SPEC. SECTION 05 05 23 AND REFERENCED WELDING CODES.

| <p align="center">TABLE 3 TESTING FOR REQUIRED SPECIAL INSPECTION REFER TO SPECIFICATION SECTION 01 45 33</p> | | | | | | |
|--|---------------|-----------------|-------------------------|--|-----------------------------|----------|
| MATERIAL | TYPE OR SCOPE | STANDARD | 2015 IBC CODE REFERENCE | FREQUENCY | BY WHOM | COMMENTS |
| GEOTECHNICAL | | | | | | |
| COMPACTED FILL | GRADATION | ASTM C117, C136 | 1705.6 | SECTION 31 23 23, FILL AND BACKFILL | CONTRACTOR'S TESTING AGENCY | |
| COMPACTED FILL | COMPACTION | ASTM D1557 | 1705.6 | SECTION 31 23 23, FILL AND BACKFILL | CONTRACTOR'S TESTING AGENCY | |
| COMPACTED FILL | DENSITY | ASTM D6938 | 1705.6 | SECTION 31 23 23, FILL AND BACKFILL | CONTRACTOR'S TESTING AGENCY | |
| PREPARED SUBGRADE | DENSITY | ASTM D1557 | 1705.6 | SECTION 31 23 13, SUBGRADE PREPARATION | CONTRACTOR'S TESTING AGENCY | |
| CONCRETE | | | | | | |
| CONCRETE | STRENGTH | ASTM C39 | 1705.3 | ONCE EACH DAY, BUT NOT LESS THAN ONE SAMPLE FOR EACH 150 CUBIC YARDS OR 5,000 SFT OF WALLS OR SLABS PLACED | CONTRACTOR'S TESTING AGENCY | |
| CONCRETE | SLUMP | ASTM C143, C94 | 1705.3 | ONE SAMPLE PER STRENGTH TEST | CONTRACTOR'S TESTING AGENCY | |
| CONCRETE | AIR CONTENT | ASTM C231, C94 | 1705.3 | ONE SAMPLE PER STRENGTH TEST | CONTRACTOR'S TESTING AGENCY | |
| CONCRETE | TEMPERATURE | ASTM C1064 | 1705.3 | ONE SAMPLE PER STRENGTH TEST | CONTRACTOR'S TESTING AGENCY | |

TABLE 4

**REQUIRED SPECIAL INSPECTION FOR SEISMIC RESISTANCE FOR STRUCTURAL SYSTEMS
REFER TO TABLE 2 FOR STANDARD STRUCTURAL SPECIAL INSPECTION REQUIREMENTS
REFER TO SPECIFICATION SECTION 01 45 33**

The Seismic Design Category (SDC) for this Project is C.
Special inspection for seismic resistance is not required.

TABLE 5

REQUIRED SPECIAL INSPECTION FOR WIND RESISTANCE FOR STRUCTURAL SYSTEMS

REFER TO SPECIFICATION SECTION 01 45 33

Special Inspection for wind resistance is not required on this project.

TABLE 6
TESTING FOR SEISMIC RESISTANCE
REFER TO SPECIFICATION SECTION 01 45 33

Testing for seismic resistance is not required.

**SECTION 03 30 10
STRUCTURAL CONCRETE**

PART 1 GENERAL

1.01 GENERAL

- A. Work shall conform to requirements of ACI 301-10, Specifications for Structural Concrete, unless otherwise specified.

1.02 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Concrete Institute (ACI):
 - a. 117, Specifications for Tolerances for Concrete Construction and Materials.
 - b. 301-10, Specifications for Structural Concrete.
 - c. 305.1, Specification for Hot Weather Concreting.
 - d. 306.1, Specification for Cold Weather Concreting.
 - e. 308.1-11, Specification for Curing Concrete.
 - f. 350.1, Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures.
 - g. SP-66, Detailing Manual.
 2. ASTM International (ASTM):
 - a. A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - b. A497/A497M, Standard Specification for Steel Welded Reinforcement, Deformed, for Concrete.
 - c. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - d. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - e. C33/C33M, Standard Specification for Concrete Aggregates.
 - f. C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - g. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - h. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - i. C150/C150M, Standard Specification for Portland Cement.
 - j. C231/C231M, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - k. C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
 - l. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

- m. C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
- n. C595/C595M, Standard Specification for Blended Hydraulic Cements.
- o. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- p. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- q. C920, Specification for Elastomeric Joint Sealants.
- r. C989, Standard Specification for Slag Cement for Use in Concrete and Mortars.
- s. C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.
- t. C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- u. C1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- v. C1218/C1218M, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
- w. C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
- x. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
- y. C 1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- z. C1567, Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
- aa. C1602/C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- bb. D226, Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- cc. D227, Specification for Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing.
- dd. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- ee. D1056, Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
- ff. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- gg. D1752, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

- hh. D2240, Standard Test Method for Rubber Property – Durometer Hardness.
- ii. E329, Standard Specification for Agencies Engaged in Construction Inspection, Special Inspection, or Testing Materials Used in Construction.
- 3. Concrete Reinforcing Steel Institute (CRSI):
 - a. Manual of Standard Practice.
 - b. Recommended Practice for Placing Reinforcing Bars.
- 4. Corps of Engineers (COE): CRD-C-572, Corps of Engineers Specifications for Polyvinylchloride Waterstop.
- 5. National Ready Mixed Concrete Association (NRMCA).
- 6. NSF International (NSF): 61, Drinking Water System Components - Health Effects.

1.03 DEFINITIONS

- A. Cold Weather: When ambient temperature is below 40 degrees F or is approaching 40 degrees F and falling.
- B. Contractor’s Licensed Design Engineer: Individual representing Contractor who is licensed to practice engineering as defined by statutory requirements of professional licensing laws in state or jurisdiction in which Project is to be constructed.
- C. Defective Area: Surface defects that include honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than 3/4 inch in diameter, cracks in liquid containment structures and below grade habitable spaces that are 0.005-inch wide and wider, and cracks in other structures that are 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances and include but are not limited to fins, form pop-outs, and other projections. At exposed concrete, defective areas also include texture irregularities, stains, and other color variations that cannot be removed by cleaning.
- D. Exposed Concrete: Concrete surface that can be seen inside or outside of structure regardless of whether concrete is above water, dry at all times, or can be seen when structure is drained.
- E. Hot Weather: As defined in ACI 305.1.
- F. Hydraulic Structure: Liquid containment structure.
- G. New Concrete: Concrete less than 60 days old.
- H. Top Bars: Horizontal bars placed such that 12 inches of fresh concrete is cast below in single placement.

1.04 DESIGN REQUIREMENTS

- A. Design formwork to provide specified concrete finishes.

1.05 QUALITY ASSURANCE

- A. Qualifications:

1. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.
2. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in jurisdiction of the Work. Requirement may be waived if individual is Contractor's Licensed Design Engineer.
3. Flatwork Finisher: Unless otherwise permitted, at least one person on finishing crew shall be certified as an ACI Flatwork Finisher, or equivalent.
4. Testing Agency: Unless otherwise permitted, an independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
 - a. Where field testing is required of Contractor, personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

- B. Preinstallation Conference:

1. Required Meeting Attendees:
 - a. Contractor, including pumping, placing and finishing, and curing subcontractors.
 - b. Ready-mix producer.
 - c. Admixture representative.
 - d. Testing and sampling personnel.
 - e. Engineer who authored Statement of Special Inspection Plan or Engineer's designee.
2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
3. Agenda shall include:
 - a. Admixture types, dosage, performance, and redosing at Site.
 - b. Mix designs, test of mixes, and Submittals.
 - c. Placement methods, techniques, equipment, consolidation, and form pressures.
 - d. Slump or slump flow and placement time to maintain slump and slump flow.
 - e. Finish, curing, and water retention.

- f. Protection procedures for weather conditions.
 - g. Other specified requirements requiring coordination.
4. Conference minutes as specified in Section 01 31 19, Project Meetings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Unload, store, and handle bars in accordance with CRSI publication “Placing Reinforcing Bars.”

PART 2 PRODUCTS

2.01 FORMWORK

A. Form Materials:

- 1. For exposed areas, use hard plastic finished plywood, overlaid waterproof particle board, or steel in “new and undamaged” condition, of sufficient strength and surface smoothness to produce specified finish.
- 2. For unexposed areas, use new shiplap or plywood.
- 3. Earth cuts may be used for forming footings.

- B. Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

C. Form Ties:

- 1. Material: Steel.
- 2. Spreader Inserts:
 - a. Conical or spherical type.
 - b. Design to maintain positive contact with forming material.
 - c. Furnish units that will leave no metal closer than 1.5 inches to concrete surface when forms, inserts, and tie ends are removed.
- 3. Wire ties not permitted.

2.02 CONCRETE

A. Materials:

- 1. Cementitious Materials:
 - a. Cement:
 - 1) Portland Cement: Unless otherwise specified, conform to requirements of ASTM C150/C150M.
 - 2) Blended Hydraulic Cement:
 - a) Unless otherwise specified, conform to requirements of ASTM C595/C595M.

- b) Portland cement used in blended hydraulic cement; conform to requirements of ASTM C150/C150M.
 - 3) Furnish from one source.
 - b. Supplementary Cementitious Materials (SCM):
 - 1) Fly Ash (Pozzolan): Class F and Class C fly ash in accordance with ASTM C618, except as modified herein:
 - a) ASTM C618, Table 1, Loss on Ignition: Unless permitted otherwise, maximum 3 percent.
 - 2) Slag Cement: In accordance with ASTM C989, Grades 100 or 120.
2. Aggregates: Unless otherwise permitted, furnish from one source for each aggregate type used in a mix design.
 - a. Aggregates:
 - 1) In accordance with ASTM C33/C33M, except as modified herein.
 - a) Class Designation: 4S unless otherwise specified.
 - b) Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
 - c) Alkali Silica Reactivity: See Article Concrete Mix Design.
 - 2) Fine Aggregates:
 - a) Clean, sharp, natural sand.
 - b) ASTM C33/C33M.
 - c) Limit deleterious substances in accordance with ASTM C33/C33M, Table 2 and as follows:
 - (1) Limit material finer than 75- μ m (No. 200) sieve to 3 percent mass of total sample.
 - (2) Limit coal and lignite to 0.5 percent.
 - 3) Coarse Aggregate:
 - a) Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
 - b) Limit deleterious substances in accordance with ASTM C33/C33M, Table 4 for specified class designation.
3. Admixtures: Unless otherwise permitted, furnish from one manufacturer.
 - a. Characteristics:
 - 1) Compatible with other constituents in mix.
 - 2) Contain at most, only trace amount chlorides in solution.
 - 3) Furnish type of admixture as recommended by manufacturer for anticipated temperature ranges.

- b. Waterproofing Admixture: A crystalline waterproofing admixture shall be used for all water retaining structures. The admixture shall conform to ASTM C 494, Type D or S. The admixture shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The admixture shall cause the concrete to become sealed against penetrations of liquids from any direction and shall protect the concrete from deterioration due to harsh environmental conditions. The admixture shall be capable of sealing hairline cracks and resisting extreme hydrostatic pressure. Acceptable products are “Xypex Admix C-500 NF” by Xypex Chemical Corporation, “MasterLife® 300D” by BASF Corporation, and “Krystol Internal Membrane (KIM)” by Kryton International Inc. Submit certified letter from manufacturer of crystalline waterproofing admixture stating required dosage rate for job specific concrete mix. Precast manufacturer shall provide documentation that crystalline waterproofing admixture was included in concrete being placed.
- ~~b.c.~~ Air-Entraining Admixture: ASTM C260/C260M.
- ~~e.d.~~ Water-Reducing Admixture: ASTM C494/C494M, Type A or Type D.
- ~~d.e.~~ Retarding Admixture: ASTM C 494/C 494M, Type B.
- ~~e.f.~~ Accelerating Admixture: ASTM C 494/C 494M, Type C.
- ~~f.g.~~ High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F or Type G.
- ~~g.h.~~ Plasticizing Admixture: ASTM C1017/C1017M, Type I or Type II.
- ~~h.i.~~ Shrinkage Reducing Admixture:
- 1) Manufacturers and Products:
 - a) BASF Admixtures Inc., Shakopee, MN; Tetraguard AS20.
 - b) Euclid Chemical Co., Cleveland, OH; Eucon SRA Series.
 - c) W. R. Grace & Co., Cambridge, MA; Eclipse Series.
- ~~i.j.~~ Do not use calcium chloride as an admixture.
- ~~j.k.~~ Admixtures with no standard, ASTM or other, designation may be used where permitted.
4. Water and Ice: Mixing water for concrete and water used to make ice shall be potable water, unless alternative sources of water are permitted.
- a. Water from alternative sources shall comply with requirements of ASTM C1602/C1602M, and concentration of chemicals in combined mixing water shall be less than:
 - 1) Chloride Content: 1,000 ppm.
 - 2) Sulfate Content as SO₄: 3,000 ppm.
 - 3) Alkalis as (Na₂O + 0.658 K₂O): 600 ppm.
 - 4) Total Solids by Mass: Less than 50,000 ppm.

B. Concrete Mix Design:

1. General:

- a. See Supplement at the end of this section for mix design requirements for each class of concrete used on Project.
- b. Prepare design mixtures for each type and strength of concrete, selecting and proportioning ingredients in accordance with requirements of ACI 301, unless otherwise specified.
- c. Selection of constituent materials and products in mix design are optional, unless specified otherwise.
- d. Unless otherwise permitted, use water-reducing admixture or water-reducing admixture and high-range, water-reducing admixture, or plasticizing admixture in pumped concrete, in concrete with a water-cementitious materials ratio below 0.50, and in concrete that is part of a liquid-containment structure.
- e. Unless otherwise permitted, use water-reducing admixture and high-range, water-reducing admixture, or plasticizing admixture in columns, piers, pilasters, and walls.
- f. Use water-reducing admixture or high-range, water-reducing admixture, or plasticizing admixture to achieve fresh properties that facilitate handling, placing, and consolidating of concrete, and specified hardened properties.
- g. Use water-reducing and retarding admixture when anticipated high temperatures, low humidity, or other adverse placement conditions can adversely affect fresh properties of concrete.
- h. Unless otherwise specified, desired fresh properties of concrete shall be determined by Contractor, and coordinated with concrete producer. Fresh properties of concrete shall remain stable to satisfaction of Contractor, for duration of placement and consolidation, and shall remain in conformance with requirements of Contract Documents.
- i. Contractor is encouraged to consider using environmentally sustainable concrete mix design technologies such as use of supplementary cementitious materials, aggregate packing, and self-consolidating concrete.

2. Potential alkali-aggregate reactivity of concrete:

- a. Do not use aggregates known to be susceptible to alkali-carbonate reaction (ACR).
- b. Aggregates shall have been tested to determine potential alkali-aggregate reactivity in concrete in accordance with ASTM C1260/C1260M or ASTM C1567.
 - 1) Aggregates that indicate expansion greater than 0.10 percent at 16 days after casting shall not be used unless they have been shown to be non-deleteriously reactive in accordance with ASTM C1293, with less than 0.04 percent expansion at 1 year for cement-aggregate combinations or less than 0.04 percent expansion at 2 years for combinations with pozzolan or slag.

- 2) Alkali content of cement used in proposed concrete mixture shall not be greater than alkali content of cement used in test for potential alkali-aggregate reactivity.
- c. Use low alkali cement and incorporate pozzolans into the concrete mixture as necessary to satisfy testing for potential alkali reactivity.
3. Proportions:
 - a. Design mix to meet aesthetic, durability, and strength requirements.
 - b. Where fly ash is included in mix, minimum fly ash content shall be a minimum of 15 percent of weight of total cementitious materials.
4. Slump or Slump Flow:
 - a. Unless otherwise specified, Contractor shall select a target slump or slump flow at the point of delivery of concrete mixtures for each application.
 - b. Selected target slump shall not exceed 9 inches.
 - c. Selected target slump flow shall not exceed 30 inches.
 - d. Concrete shall show no signs of visible segregation.
 - e. The target slump or slump flow value shall be enforced for the duration of Project.
 - f. Determine the slump by ASTM C143/C143M.
 - g. Slump tolerances shall meet the requirements of ACI 117.
 - h. Determine slump flow by ASTM C1611/C1611M.
 - i. Slump flow tolerances shall meet the requirements of ASTM C94/C94M.
 - j. Unless otherwise permitted, target slump value is 4 inches at point of delivery, for concrete without high-range, water-reducing admixture.
 - k. Design mixes that include a high-range, water-reducing or a plasticizing admixture shall have a minimum slump of 2 inches prior to addition of admixture. Unless otherwise permitted, slump shall be 8 inches maximum at point of delivery, for concrete with a high-range, water-reducing admixture.
 - l. Slump tolerance shall meet requirements of ACI 117.

C. Concrete Mixing:

1. General: In accordance with ACI 301, except as modified herein.
2. Truck Mixers:
 - a. For every truck, test slump or slump flow of samples taken per ASTM C94/C94M, paragraph 12.5.1.
 - b. Where specified slump is more than 4 inches, and if slump tests differ by more than 2 inches, discontinue use of truck mixer, unless causing condition is corrected and satisfactory performance is verified by additional slump tests.

2.03 REINFORCING STEEL

- A. Deformed Steel Reinforcing Bars: ASTM A615/A615M, Grade 60. Welding of reinforcing bars is not permitted.
- B. Fabrication: Follow CRSI Manual of Standard Practice.

2.04 ANCILLARY MATERIALS

- A. Bonding Agent: Unless otherwise specified, in accordance with the following:
 - 1. ASTM C881/C881M, Type V.
 - 2. Two-component, moisture insensitive, 100 percent solids epoxy.
 - 3. Consult manufacturer for surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.
 - 4. Manufacturers and Products:
 - a. BASF Building Systems Inc., Shakopee, MN; Masterinject 1500.
 - b. Euclid Chemical Co., Cleveland, OH; Euco # 352 Epoxy System LV.
 - c. Prime Resins, Conyers, GA; Prime Bond 3000 to 3900 Series.
 - d. Sika Chemical Corp., Lyndhurst, NJ; Sikadur 32 Hi-Mod.
- B. Bond Breaker:
 - 1. Nonstaining type, providing positive bond prevention.
 - 2. Manufacturers and Products:
 - a. Dayton Superior Corporation, Kansas City, KS; EDOCO Clean Lift Bond Breaker.
 - b. Nox-Crete Products Group, Omaha, NE; Silcoseal Select.
- C. Tie Wire:
 - 1. Black, soft-annealed 16-gauge wire.
 - 2. Nylon-, epoxy-, or plastic-coated wire.
- D. Bar Supports and Spacers:
 - 1. Use precast concrete bar supports and side form spacers, unless noted otherwise. Do not use other types of supports or spacers.
 - 2. Bar supports shall have sufficient strength and stiffness to carry loads without failure, displacement, or significant deformation. Space bar supports so minimum concrete cover is maintained for reinforcing between supports.
- E. Plastic Waterstop:
 - 1. Extruded from elastomeric plastic compound of which basic resin shall be prime virgin polyvinyl chloride (PVC). Compound shall not contain scrapped material, reclaimed material, or pigment.

2. Specific Gravity: Approximately 1.37.
3. Shore Durometer Type A Hardness: Approximately 80.
4. Performance Requirements: COE Specification CRD-C-572.
5. Type Required in Contraction and Control Joints: 6 inches wide and parallel longitudinal ribs or protrusions on each side of strip center, as indicated on Drawings.
6. Type Required in Construction Joints: Flat ribbed with same dimensional properties as described above.
7. Corrugated or tapered type waterstops are not acceptable.
8. Thickness: Constant from center bulb (or center of waterstop), to outside stop edge.
9. Waterstop Weight: 1.60 pounds for 3/8 inch by 6 inches, minimum per foot.
10. Factory Fabrications: Use only factory fabrications for intersections, transitions, and changes of direction.
11. Manufacturers and Products:
 - a. Center Bulb Type:
 - 1) Vinylex Corp., Knoxville, TN; Catalog No. 03250/VIN: No. RB6-38H (6 inches by 3/8 inch).
 - 2) Greenstreak Plastic Products, St. Louis, MO; Catalog No. 03150/GRD: Style 732 (6 inches by 3/8 inch).
 - 3) Four Seasons Industries Durajoint, Garrettsville, OH; Catalog No. CSP-162: Type 9 (6 inches by 3/8 inch).
 - 4) BoMetals, Carrollton, GA; Catalog No. RCB-638LB (6 inches by 3/8 inch).
 - 5) Dacon Plastics LLC, Portland, OR, (903) 245-0048; Catalog No. DR004 (6 inches by 3/8 inch).
 - b. Flat Ribbed Profile: Use same manufacturers as bulb type.

2.05 HYDROPHILIC WATERSTOP

- A. For use at construction joints only, where new concrete is placed against existing concrete and as shown on Drawings.
- B. Material shall be a non-bentonite hydrophilic rubber compound.
- C. Manufacturers and Products:
 1. Greenstreak Plastic Products, St. Louis, MO; Hydrotite CJ-1020-2K with Leakmaster LV-1 adhesive and sealant.
 2. Adeka Ultra Seal, JLM Associates, Spearfish, SD; MC-2010M with 3M-2141 adhesive and P-201 sealant.
- D. Premolded Joint Filler:
 1. Bituminous Type: ASTM D994 or ASTM D1751.

2. Sponge Rubber:
 - a. Neoprene, closed-cell, expanded; ASTM D1056, Type 2C5, with compression deflection, 25 percent deflection (limits), 119 kPa to 168 kPa (17 psi to 24 psi) minimum.
 - b. Manufacturer and Product: Monmouth Rubber and Plastics Corporation, Long Branch, NJ; Durafoam DK515IHD.
 3. Self-Expanding Cork:
 - a. ASTM D1752, Type III.
 - b. Manufacturer and Product: WR Meadows, Inc., Hampshire, IL; Self-expanding cork. (800) 342-5976.
- E. Curing Compound:
1. Water-based, high-solids content, nonyellowing, curing compound meeting requirements of ASTM C1315 Type I, Class A.
 2. Manufacturers and Products:
 - a. BASF Construction Chemicals, Shakopee, MN; Kure 1315.
 - b. Euclid Chemical Co., Cleveland, OH; Super Diamond Clear VOX.
 - c. WR Meadows, Inc., Hampshire, IL; VOCOMP-30.
 - d. Vexcon Chemical, Inc.; Philadelphia, PA; Starseal 1315.
 - e. Dayton Superior; Safe Cure and Seal 1315 EF.
- F. Evaporation Retardant:
1. Optional: Fluorescent fugitive dye color tint that disappears completely upon drying.
 2. Manufacturers and Products:
 - a. BASF Construction Chemicals, Shakopee, MN; Confilm.
 - b. Euclid Chemical Co., Cleveland, OH; Eucobar.
- G. Nonshrink Grout:
1. Nonmetallic, nongas-liberating.
 2. Prepackaged natural aggregate grout requiring only the addition of water.
 3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
 4. Test in accordance with ASTM C1107/C1107M:
 - a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
 - b. Temperatures of 40 degrees F, 80 degrees F, and 100 degrees F.
 5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
 6. Minimum strength of fluid grout, 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.
 7. Maintain fluid consistency when mixed in 1 yard to 9 yard loads in ready-mix truck.

8. Manufacturers and Products:
 - a. BASF Building Systems, Inc., Shakopee, MN; Master Flow 928.
 - b. Five Star Products Inc., Fairfield, CT; Five Star Fluid Grout 100.
 - c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
 - d. Dayton Superior Corp., Kansas City, KS; Sure Grip High Performance Grout.
 - e. L & M Construction Chemicals, Inc., Omaha, NE; Crystex.

H. Repair Material:

1. Contain only trace amounts of chlorides and other chemicals that can potentially cause steel to oxidize.
2. Where repairs of exposed concrete are required, prepare mockup using proposed repair materials and methods, for confirmation of appearance compatibility prior to use.
3. Obtain Manufacturer's Certificate of Compliance that products selected are appropriate for specific applications.
4. Repair mortar shall be Site mixed.
5. Prepare concrete substrate and mix, place, and cure repair material in accordance with manufacturer's written recommendations.
6. Manufacturers and Products:
 - a. BASF Building Systems Inc., Shakopee, MN; EMACO S-Series products.
 - b. Sika Chemical Corp., Lyndhurst, NJ; SikaTop-Series.

I. Crack Repair:

1. Obtain Letter of Certification from manufacturer's technical representative, that products selected are appropriate for the specific applications.
2. Prepare concrete substrate and mix, place, and cure repair material in accordance with manufacturer's written recommendations.
3. When crack repair is deemed by Engineer as requiring a structural repair, use part epoxy injection resin.
 - a. Manufacturers:
 - 1) BASF Building Systems, Inc., Shakopee, MN.
 - 2) Euclid Chemical Co., Cleveland, OH.
 - 3) Prime Resins, Conyer, GA.
 - 4) Sika Chemical Corp., Lyndhurst, NJ.
4. Unless otherwise specified, use hydrophilic polyurethane resin.
 - a. Manufacturers:
 - 1) Prime Resins, Conyer, GA.
 - 2) Sika Chemical Corp., Lyndhurst, NJ.

2.06 SOURCE QUALITY CONTROL

- A. Source Quality Control Inspection: Engineer shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in this section.

PART 3 EXECUTION**3.01 FORMWORK****A. Form Construction:**

1. Construct forms and provide smooth-form finish.
2. Form 3/4-inch bevels at concrete edges, unless otherwise shown.
3. Make joints tight to prevent escape of mortar and to avoid formation of fins.
4. Brace as required to prevent distortion during concrete placement.
5. On exposed surfaces, locate form ties in uniform pattern or as shown.
6. Construct so ties remain embedded in the member with no metal within 1 inch of concrete surface when forms, inserts, and tie ends are removed.

B. Form Removal:

1. Nonsupporting forms (walls and similar parts of Work) may be removed after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placement if:
 - a. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
 - b. Curing and protection operations are maintained.
2. Remove forms with care to prevent scarring and damaging the surface.
3. Prior to form removal, provide thermal protection for concrete being placed under the requirements of cold weather concreting.

3.02 PLACING REINFORCING STEEL

A. Unless otherwise specified, place reinforcing steel in accordance with CRSI Recommended Practice for Placing Reinforcing Bars.

B. Splices and Laps:

1. Lap splice reinforcing: Refer to Structural General Notes in Drawings for additional information.
2. Tie splices with 18-gauge annealed wire as specified in CRSI Standard.

3.03 INSTALLATION OF WATERSTOPS**A. General:**

1. Continuous waterstop (as specified) shall be installed in all construction joints in walls and slabs of water holding basins and channels and in walls of belowgrade structures, unless specifically noted otherwise.
2. Join waterstop at intersections to provide continuous seal.
3. Center waterstop on joint.
4. Secure waterstop in correct position. Tie waterstop to reinforcing steel using grommets, "Hog Rings," or tie wire at maximum spacing of 12 inches. Do not displace waterstop during concrete placement.

5. Repair or replace damaged waterstop.
6. Place concrete and vibrate to obtain impervious concrete in vicinity of joints.
7. Joints in Footings and Slabs:
 - a. Ensure that space beneath plastic waterstop is completely filled with concrete.
 - b. During concrete placement, make visual inspection of waterstop area.
 - c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, then place remaining concrete to full height of slab.
8. Plastic Waterstop:
 - a. Install in accordance with manufacturer's written instructions.
 - b. Splice in accordance with waterstop manufacturer's written instructions using Teflon-coated thermostatically controlled heating iron at approximately 380 degrees F.
 - 1) Allow at least 10 minutes before new splice is pulled or strained in any way.
 - 2) Finished splices shall provide cross section that is dense and free of porosity with tensile strength of not less than 80 percent of unspliced materials.
 - 3) Use only factory made waterstop fabrications for all intersections, changes of directions and transitions.
 - 4) Field splice permitted only for straight butt welds.
 - c. Wire looped plastic waterstop may be substituted for plastic waterstop.
9. Hydrophilic Waterstop:
 - a. Install in accordance with manufacturer's written instructions.
 - b. Provide minimum of 2-1/2 inches of concrete cover over waterstop. When structure has two layers of steel reinforcement, locate centered between layers of steel or as shown.
 - c. Apply adhesive to concrete surface and allow to dry for specified time before applying waterstop strip.
 - d. Lap ends of waterstop strip together at splices and corners and join with sealant.
 - e. Verify that waterstop is anchored firmly in place before placing concrete. Do not allow vibrator to come into contact with waterstop.
 - f. Lap hydrophilic waterstop 2 feet minimum with intersecting plastic waterstops.

3.04 CONCRETE PLACEMENT INTO FORMWORK

- A. Inspection: Notify Engineer and Special Inspector at least one work day in advance before starting to place concrete.

B. Placement into Formwork:

1. Reinforcement: Secure in position before placing concrete.
2. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs that shall be placed full depth. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
3. Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
4. Use placement devices, for example, chutes, pouring spouts, and pumps as required to prevent segregation.
5. Vertical Free Fall Drop to Final Placement:
 - a. Forms 8 Inches or Less Wide: 5 feet.
 - b. Forms Wider than 8 Inches: 8 feet, except as specified.
6. For placements where drops are greater than specified, use placement device such that free fall below placement device conforms to required value.
 - a. Limit free fall to prevent segregation caused by aggregates hitting steel reinforcement.
7. Provide sufficient illumination in the interior of forms so concrete deposition is visible, permitting confirmation of consolidation quality.
8. Joints in Footings and Slabs:
 - a. Ensure space beneath plastic waterstop completely fills with concrete.
 - b. During concrete placement, make visual inspection of entire waterstop area.
 - c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, and place remaining concrete to full height of slab.
 - d. Apply procedure to full length of waterstop.
9. Trowel and round off top exposed edges of walls with 1/4-inch radius steel edging tool.

C. Conveyor Belts and Chutes:

1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.
2. Do not use chutes longer than 50 feet.
3. Wipe clean with device that does not allow mortar to adhere to belt.
4. Cover conveyor belts and chutes.

D. Retempering: Not permitted for concrete where cement has partially hydrated.

E. Pumping of Concrete:

1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to ensure completion of concrete placement without cold joints in case of primary placing equipment breakdown.
2. Minimum Pump Hose (Conduit) Diameter: 4 inches.
3. Replace pumping equipment and hoses (conduits) that are not functioning properly.

F. Retempering: Not permitted for concrete where cement has partially hydrated.

G. Maximum Size of Concrete Placements:

1. Limit size of each placement to allow for strength gain and volume change as a result of shrinkage.
2. Locate expansion, control, and contraction, joints where shown.
3. Construction Joints: Unless otherwise shown or permitted, locate construction joints as follows:
 - a. Locate construction joints as shown on Drawings or where approved in the joint location submittal.
 - b. Locate expansion, control, and contraction joints where shown on Drawings.
 - c. Provide vertical construction joints at maximum spacing of 40 feet unless shown or approved otherwise.
 - d. When vertical expansion, contraction or control joint spacing does not exceed 60 feet, intermediate construction joints are not required.
 - e. Uniformly space vertical construction joints within straight sections of walls, avoiding penetrations.
4. Consider beams, girders, brackets, column capitals, and haunches as part of floor or roof system and place monolithically with floor or roof system.
5. Should placement sequence result in cold joint located below finished water surface, install waterstop in joint.

H. Minimum Time between Adjacent Placements:

1. Construction or Control Joints: 7 days.
2. Construction joint between top of footing or slab, and column or wall: As soon as can safely be done without damaging previously cast concrete or interrupting curing thereof, but not less than 24 hours.
3. Expansion or Contraction Joints: 1 day.
4. For columns and walls with a height in excess of 10 feet, wait at least 2 hours before depositing concrete in beams, girders, or slabs supported thereon.
5. For columns and walls 10 feet in height or less, wait at least 1 hour prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon.

3.05 CONSOLIDATION AND VISUAL OBSERVATION

- A. Provide at least one standby vibrator in operable condition at placement Site prior to placing concrete.

3.06 COLD WEATHER PLACEMENT

- A. Unless otherwise permitted, shall be in accordance with requirements of ACI 301, ACI 306.1 and as follows:
 - 1. Cold weather requirements shall apply when ambient temperature is below 40 degrees F or approaching 40 degrees F and falling.
 - 2. Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth shall be thawed to acceptance of Engineer.
 - 3. Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees F; requirement is applicable to all surfaces including reinforcement and other embedded items.
 - 4. Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.
 - 5. Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.
 - 6. Protect concrete from freezing until end of curing period and until concrete has attained a compressive strength of 3,500 psi or design compressive strength if less than 3,500 psi.
- B. Provide maximum and minimum temperature sensors placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work. Unless otherwise permitted, record surface temperature of concrete at least once every 12 hours during specified curing period.
- C. External Heating Units: Do not exhaust heater flue gases directly into enclosed area as it causes concrete carbonation as a result of concentrated carbon dioxide.
- D. Cure as specified.

3.07 HOT WEATHER PLACEMENT

- A. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:
 - 1. Maintain concrete temperature below 95 degrees F at time of placement, or furnish test data or other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.

2. Internal concrete temperature in structure shall not exceed 158 degrees F, and maximum temperature differential between center of section and external surfaces of concrete shall not exceed 35 degrees F.
3. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.
4. Cure as specified.

3.08 CONCRETE BONDING

A. Construction Joints at Existing Concrete:

1. Thoroughly clean and roughen existing concrete surfaces to roughness profile of 1/4 inch.
2. Saturate surface with water for 24 hours prior to placing new concrete.

3.09 PREMOLDED JOINT FILLER INSTALLATION

- A. Sufficient in width to completely fill joint space where shown.
- B. Drive nails approximately 1 foot 6 inches on center through filler, prior to installing, to provide anchorage embedment into concrete during concrete placement.
- C. Secure premolded joint filler in forms before concrete is placed.

3.10 FINISHING FORMED SURFACES

- A. Provide surface finish 2.0 (SF-2.0) in accordance with ACI 301 and as herein specified.
- B. Tie Holes: Unless otherwise specified, fill with specified repair material.
 1. Prepare substrate and mix, place, and cure repair material per manufacturer's written recommendations.
- C. Alternate Form Ties, Through-Bolts:
 1. Mechanically roughen entire interior surface of through hole.
 2. Apply bonding agent to roughened surface and drive elastic vinyl plug to half depth.
 3. Dry pack entire hole from both sides of plug with nonshrink grout.
 4. Use only enough water to dry pack grout.
 5. Dry pack while bonding agent is still tacky.
 6. If bonding agent has dried, remove bonding agent by mechanical means and reapply new coat of bonding agent.

7. Compact grout using steel hammer and steel tool to drive grout to high density.
8. Cure grout per grout manufacturer's written recommendations.

D. Repair defective areas of concrete.

1. Cut edges perpendicular to surface at least 1/2-inch deep. Do not feather edges. Soak area with water for 24 hours.
2. Patch with specified repair material.
3. Repair concrete surfaces using specified materials. Select system, submit for review, and obtain approval from Engineer prior to use.
4. Develop repair techniques with material manufacturer on surface that will not be visible in final construction prior to starting actual repair work and show how finish color will blend with adjacent surfaces. Obtain approval from Engineer.
5. Obtain quantities of repair material and manufacturer's detailed instructions for use to provide repair with finish to match adjacent surface or apply sufficient repair material adjacent to repair to blend finish appearance.
6. Repair of concrete shall provide structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Engineer.

E. Inject cracks that leak.

3.11 FINISHING UNFORMED SURFACES

A. General:

1. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
2. Do not use "jitterbugs" or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.
3. Do not dust surfaces with dry materials nor add water to surfaces.
4. Cure concrete as specified.

B. Slab Tolerances:

1. Exposed Slab Surfaces: Comprise of flat planes as required within tolerances specified.
2. Slab Finish Tolerances and Slope Tolerances: Crowns on floor surface not too high as to prevent 10-foot straightedge from resting on end blocks, nor low spots that allow block of twice the tolerance in thickness to pass under supported 10-foot straightedge.
3. Steel gauge block 5/16-inch thick.

4. Finish Slab Elevation: Slope slabs to floor drain and gutter, and shall adequately drain regardless of tolerances.
 5. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown. Where thickness tolerance will not affect slope, drainage, or slab elevation, thickness tolerance may exceed 1/2 inch plus.
- C. Interior Slab Finish: Provide trowel finish unless specified otherwise.
- D. Exterior Slab Finish:
1. Provide broom finish unless specified otherwise.
 2. Finish exposed edges with steel edging tool.
 3. Mark sidewalks transversely at 5-foot intervals with jointing tool.

3.12 EXPOSED METAL OBJECTS

- A. Remove metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, by chipping back concrete to depth of 1 inch and then cutting or removing metal object.
- B. Repair area of chipped-out concrete as specified for defective areas.

3.13 BLOCKOUTS AT PIPES OR OTHER PENETRATIONS

- A. Where shown, install in accordance with requirements of Drawings.

3.14 PROTECTION AND CURING

- A. Protect and cure concrete in accordance with requirements of ACI 301, ACI 308.1, and as follows:
 1. Protect fresh concrete from direct rays of sunlight, drying winds, and wash by rain.
 2. Keep concrete slabs continuously wet for a 7-day period. Intermittent wetting is not acceptable.
 3. Use curing compound only where approved by Engineer.
 4. Cure formed surfaces with curing compound applied in accordance with manufacturer's written instructions as soon as forms are removed and finishing is completed.
 5. Remove and replace concrete damaged by freezing.
 6. Repair areas damaged by construction, using specified repair materials and approved repair methods.

3.15 NONSHRINK GROUT

- A. General: Mix, place, and cure nonshrink grout in accordance with grout manufacturer's written instructions.

B. Grouting Machinery Foundations:

1. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material.
2. Set machinery in position and wedge to elevation with steel wedges, or use cast-in leveling bolts.
3. Form with watertight forms at least 2 inches higher than bottom of plate.
4. Fill space between bottom of machinery base and original concrete in accordance with manufacturer's written instructions.

3.16 BACKFILL AGAINST STRUCTURES

- A. Do not backfill against walls until concrete has obtained specified 28-day compressive strength.
- B. Refer to General Structural Notes on the Drawings for additional requirements, including elevated slab completion prior to backfill.
- C. Unless otherwise permitted, place backfill simultaneously on both sides of structure, where such fill is required, to prevent differential pressures.

3.17 FIELD QUALITY CONTROL

A. General:

1. Provide adequate facilities for safe storage and proper curing of concrete test specimens onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
2. Unless otherwise specified, sample concrete for testing for making test specimens, from point of delivery.
3. When concrete is pumped, sample and test air content at point of delivery and at point of placement.
 - a. For Each Concrete Mixture: Provided results of air content tests for first load of the day are within specified limits, testing need only be performed at point of delivery for subsequent loads of that concrete mixture except that testing should be performed at point of placement every 4 hours.
4. Evaluation will be in accordance with ACI 301 and Specifications.
5. Test specimens shall be made, cured, and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.
6. Frequency of testing may be changed at discretion of Engineer.
7. Pumped Concrete: Take concrete samples for slump, ASTM C143/C143M, and test specimens, ASTM C31/C31M and ASTM C39/C39M, and shrinkage specimens (ASTM C157/C157M) at placement (discharge) end of line.

8. If measured air content at delivery is greater than specified limit, check test of air content will be performed immediately on a new sample from delivery unit. If check test fails, concrete has failed to meet requirements of Contract Documents. If measured air content is less than lower specified limit, adjustments will be permitted in accordance with ASTM C94/C94M, unless otherwise specified. If check test of adjusted mixture fails, concrete has failed to meet requirements of Contract Documents. Concrete that has failed to meet requirements of Contract Documents shall be rejected.

B. Concrete Strength Test:

1. Unless otherwise specified, one specimen at age of 7 days for information, and two 6-inch diameter or when permitted three 4-inch diameter test specimens at age of 28 days for acceptance.
2. If result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, extend period of moist curing by 7 additional days.
3. Provide a minimum of one spare test specimen per sample. Test spare cylinder as directed by Engineer.

C. High Range Water Reducer (Superplasticizer) Admixture Segregation Test: Test each truck prior to use on job.

1. Segregation Test Objective: Concrete shall stay together when slumped. Segregation is assumed to cause mortar to flow out of mix even though aggregate may stay piled enough to meet slump or slump flow test.
2. Test Procedure: Make slump or slump flow test and check for excessive slump or slump flow, and observe to see if mortar or moisture flows from slumped concrete.
3. Reject concrete if mortar or moisture separates and flows out of mix.

D. Cold Weather Placement Tests:

1. During cold weather concreting, cast cylinders for field curing as follows. Use method that will produce greater number of specimens:
 - a. Six extra test cylinders from last 100 cubic yards of concrete.
 - b. Minimum three specimens for each 2 hours of placing time or for each 100 cubic yards.
2. These specimens shall be in addition to those cast for lab testing.
3. Protect test cylinders from weather until they can be placed under same protection provided for concrete of structure that they represent.
4. Keep field test cylinders in same protective environment as parts of structure they represent to determine if specified strength has been obtained.
5. Test cylinders in accordance with applicable sections of ASTM C31/C31M and ASTM C39/C39M.
6. Use test results to determine specified strength gain prior to falsework removal.

- E. Slab Finish Tolerances and Slope Tolerances:
1. Support 10-foot long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.
 2. Compliance with designated limits in four of five consecutive measurements is satisfactory, unless defective conditions are observed.

3.18 MANUFACTURER'S SERVICES

- A. Provide representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection, and certification of proper installation for concrete ingredients, mix design, mixing, and placement.
- B. Concrete Producer Representative:
1. Observe how concrete mixes are performing.
 2. Concrete Producer Representative:
 - a. Observe how concrete mixes are performing.
 - b. Be present during first placement of each type of concrete mix.
 - c. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project, including instructions for redosing.
 - d. Establish control limits on concrete mix designs.
 - e. Provide equipment for control of concrete redosing for air entrainment or high-range, water-reducing admixture, superplasticizers, at Site to maintain proper slump or slump flow, and air content when specified.
 3. Admixture Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.
 4. Bonding Agent Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.

3.19 SUPPLEMENTS

- A. Requirements of concrete mix designs following "End of Section," are a part of this Specification and supplement requirements of Part 1 through Part 3 of this section:
1. Concrete Mix Design, Class 4500F1S1P2C1.

END OF SECTION

CONCRETE MIX DESIGN, CLASS 4500F1S1P2C1

- A. Mix Locations: Typical, unless otherwise specified.
- B. Exposure Categories and Classifications: F1S1P2C1.
- C. Mix Properties:
1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.40.
 2. Minimum concrete compressive strength (f'_c) shall be 4,500 psi at 28 days.
 3. Air-entraining admixtures are prohibited in concrete mixtures and total air content shall not be greater than 3 percent, for the following:
 - a. Slabs to receive hard-troweled finish.
 - b. Slabs to receive dry shake floor hardener.
 - c. Slabs to receive topping placed monolithically as two-course floor on top of plastic concrete.
 4. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

| Nominal Maximum Aggregate Size in.‡ | Air Content (%)* |
|--|---------------------|
| 3/8 | 7.5 |
| 1/2 | 7.0 |
| 3/4 | 6.0 |
| 1 | 6.0 |
| 1-1/2 | 5.5 |
| 2 [§] | 5.0 |
| 3 [§] | 4.5 |

‡See ASTM C33/C33M for tolerance on oversize for various nominal maximum size designations.

*Tolerance of air content is $\pm 1-1/2$ percent.

§Air contents apply to total mixture. When testing concretes, however, aggregate particles larger than 1-1/2 inches are to be removed by sieving and air content will be measured on sieved fraction (tolerance on air content as delivered applies to this value). Air content of total mixture is computed from value measured on the sieved fraction passing the 1-1/2-inch sieve in accordance with ASTM C231/C231M.

5. Limit supplementary cementitious materials measured as a percent of weight of total cementitious materials in mix design, as follows:
 - a. Fly Ash and other Pozzolans: 25 percent.
 - b. Slag Cement: 50 percent.

- c. Silica Fume: 10 percent.
 - d. Combined Fly Ash and other Pozzolans and Slag Cement: 50 percent, with fly ash and other pozzolans not exceeding 25 percent.
 - e. Total cementitious materials include ASTM C150/C150M and ASTM C595/C595M cement.
 - 1) Fly ash and other pozzolans in Type IP, blended cement, ASTM C595/C595M.
 - 2) Slag used in the manufacture of an IS blended cement, ASTM C595/C595M.
6. Provide cementitious materials in accordance with one of the following:
- a. ASTM C150/C150M Type II; inclusion of supplementary cementitious materials in design mix is optional.
 - b. ASTM C150/C150M types other than Type II, plus supplementary cementitious materials in accordance with one of the following:
 - 1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.
 - 2) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.
 - c. ASTM C595/C595M Type IP or Type IS (less than 70), tested to comply with moderate sulfate resistance option (MS).
 - 1) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.
7. Unless otherwise permitted, minimum cementitious materials content in mix design shall be as follows:
- a. 515 pounds per cubic yard for concrete with 1-1/2-inch nominal maximum size aggregate.
 - b. 535 pounds per cubic yard for 1-inch nominal maximum size aggregate.
 - c. 560 pounds per cubic yard for 3/4-inch nominal maximum size aggregate.
 - d. 580 pounds per cubic yard for 1/2-inch nominal maximum size aggregate.
 - e. 600 pounds per cubic yard for 3/8-inch nominal maximum size aggregate.
 - f. Unless otherwise permitted, limit cementitious materials content to 100 pounds per cubic yard greater than specified minimum cementitious materials content in mix design.
8. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent, unless otherwise specified.
- a. Regardless of assigned C Exposure Class, for prestressed and post-tensioned concrete: 0.06 percent.

- b. Limits are stated in terms of chloride ions in percent by weight of cement.
 - c. Unless otherwise permitted, provide documentation from concrete tested in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.
- D. Refer to PART 1 through PART 3 of this section for additional requirements.

SECTION 40 90 01
INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
 - a. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - b. A276, Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
 - c. A312, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
 - d. B32, Standard Specification for Solder Metal.
 - e. B88, Standard Specification for Seamless Copper Water Tube.
2. International Society of Automation (ISA):
 - a. S5.1, Instrumentation Symbols and Identification (NRC ADOPTED).
 - b. PR12.6, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations.
 - c. S5.4, Standard Instrument Loop Diagrams.
 - d. S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
 - e. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.
3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. ICS 1, General Standards for Industrial Control and Systems.
4. National Institute of Standards and Technology (NIST).
5. NSF International (NSF):
 - a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
 - b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
6. Underwriters Laboratory, Inc. (UL): 508A, Standard for Safety, Industrial Control Panels.

1.02 SUMMARY

A. Work Includes:

1. Engineering, furnishing, installing, calibrating, adjusting, testing, documenting, starting up, and Owner training for complete Process Instrumentation and Control (PIC) for plant.
2. Major parts are:
 - a. Primary elements, transmitters, and control devices.
 - b. Two control panels: one for control of the wetwell pumps (P-1-1 and P-1-2) and one for control of the filling and draining of the Equalization Tank.
 - c. Relocation of the existing remote alarming Mission System.
- B. Detailed Design: PIC as shown and specified includes functional and performance requirements and component specifications. Complete detailed PIC design.

1.03 DEFINITIONS

A. Abbreviations:

1. FDT: Factory Demonstration Test.
2. LCP: Local Control Panel.
3. MCC: Motor Control Center.
4. PAT: Performance Acceptance Test.
5. PIC: Process Instrumentation and Control.
6. PLC: Programmable Logic Controller.

B. Rising/Falling: Terms used to define actions of discrete devices about their setpoints.

1. Rising: Contacts close when an increasing process variable rises through setpoint.
2. Falling: Contacts close when a decreasing process variable falls through setpoint.

C. Signal Types:

1. Analog Signals, Current Type:
 - a. 4 mA to 20 mA dc signals conforming to ISA S50.1.
 - b. Unless otherwise indicated for specific PIC Subsystem components, use the following ISA 50.1 options:
 - 1) Transmitter Type: Number 2, two-wire.
 - 2) Transmitter Load Resistance Capacity: Class L.
 - 3) Fully isolated transmitters and receivers.

2. Analog Signals, Voltage Type: 1 to 5 volts dc within panels where a common high precision dropping resistor is used.
 3. Discrete signals, two-state logic signals using dc or 120V ac sources as indicated.
 4. Pulse Frequency Signals:
 - a. Direct current pulses whose repetition rate is linearly proportional to process variable.
 - b. Pulses generated by contact closures or solid state switches as indicated.
 - c. Power source less than 30V dc.
 5. Special Signals: Other types of signals used to transmit analog and digital information between field elements, transmitters, receivers, controllers, and digital devices.
- D. Standard Software: Software packages that are independent of Project on which they are used. Standard software includes system software, supervisory control, and data acquisition (SCADA) software.
1. System Software: Application independent (non-project specific) software developed by digital equipment manufacturers and software companies. Includes, but is not limited to, operating systems; network support, programming languages (C, C++, Visual C++, BASIC, Visual Basic, etc.); Office Suites (word processor, spreadsheet, database, etc.); e-mail; security (firewall, antivirus; spam, spyware, etc.) debugging aids; and diagnostics.
 2. SCADA Software: Software packages independent of specific process control project on which they are used. Includes, but is not limited to, providing configuring and run-time capability for, data acquisition (I/O driver, OPC servers, etc.), monitoring, alarming, human-machine interface, supervisory control, data collection, data retrieval, trending, report generation, control, and diagnostics.
 3. Controller Programming Software: Software packages for the configuring of PLCs, RTUs, DCUs, and fieldbus devices.
- E. Application Software (Programming): Software to provide functions unique to this Project and that are not provided by standard software alone, including but not limited to:
1. Configuring databases, tables, displays, historians, reports, parameter lists, ladder logic, function block, and control strategies required to implement functions unique to this Project.
 2. Programming, including HMI and PLC, in any programming or scripting language.

F. Instrument Tag Numbers:

1. A shorthand tag number notation is used in the Loop Specifications. For example: AI-1-2(2)(3)[pH].

| <u>Notation</u> | <u>Explanation</u> |
|-----------------|---|
| AI | ISA designator for Analysis Indicator. |
| 1 | Unit process number. |
| 2 | Loop number. |
| (2) | First unit number; number of same component types in a given loop; -1 and -2 in this example. |
| (3) | Second unit number; number of same component types with same first unit number in a given loop; -1, -2, and -3 in this example. |
| [pH] | Same notation shown at 2 o'clock position on ISA circle symbol on P&ID. |

2. In this example, AI-1-12(2)(3)[pH] is shorthand for:

AI-1-12-1-1[pH], AI-1-12-1-2[pH], AI-1-12-1-3[pH]
AI-1-12-2-1[pH], AI-1-12-2-2[pH], AI-1-12-2-3[pH]

1.04 QUALITY ASSURANCE

- A. Calibration Instruments: Each instrument used for calibrating PIC equipment shall bear the seal of a reputable laboratory certifying that instrument has been calibrated within the previous 12 months to a standard endorsed by the NIST.
- B. Coordination Meetings:
 1. In accordance with Section 01 31 13, Project Coordination.
 2. Location: Owner's Facility.
 3. Attended by: Engineer, Owner, and Contractor.
 4. Minimum of four are required. Specific dates will be established in Progress Schedule.
 5. First Meeting: Within 36 days after Notice to Proceed.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide Site and warehouse storage facilities for PIC equipment.
- B. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers, and related equipment as recommended by the capsule manufacturer.

- C. Prior to installation, store items in dry indoor locations. Provide heating in storage areas for items subject to corrosion under damp conditions.
- D. Cover panels and other elements that are exposed to dusty construction environments.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Standard Environmental Requirements: Unless otherwise noted, design equipment for continuous operation in these environments:
 - 1. Freestanding Panel and Consoles:
 - a. Inside, Air Conditioned: NEMA 1.
 - b. Inside: NEMA 12.
 - c. Outside: NEMA 4X.
 - 2. Smaller Panels and Assemblies (that are not Freestanding):
 - a. Inside, Air Conditioned: NEMA 12.
 - b. All Other Locations: NEMA 4X.
 - 3. Field Elements: Outside.
- B. Environmental Design Requirements: Following defines the types of environments referred to in the above.
 - 1. Inside, Air Conditioned:
 - a. Temperature:
 - 1) Normal: 60 to 80 degrees F.
 - 2) With Up to 4-Hour HVAC System Interruptions: 40 to 105 degrees F.
 - b. Relative Humidity:
 - 1) Normal: 10 percent (winter) to 70 percent (summer).
 - 2) With Up to 4-Hour HVAC System Interruption: 10 to 100 percent.
 - c. NEC Classification: Nonhazardous.
 - 2. Inside:
 - a. Temperature: 20 to 104 degrees F.
 - b. Relative Humidity: 10 to 100 percent.
 - c. NEC Classification: Nonhazardous.
 - 3. Inside, Corrosive:
 - a. Temperature: 20 to 104 degrees F.
 - b. Relative Humidity: 10 to 100 percent.
 - c. Corrosive Environment: Hydrogen sulfide gas.
 - d. NEC Classification: Nonhazardous.
 - 4. Inside, Hazardous:
 - a. Temperature: 20 to 104 degrees F.
 - b. Relative Humidity: 10 to 100 percent.
 - c. NEC Classification: As shown on Electrical Drawings.

5. Outside:
 - a. Temperature: 20 degrees F to 104 degrees F.
 - b. Relative Humidity: 10 percent to 100 percent, rain.
 - c. NEC Classification: As noted on Drawings.
6. Outside, Corrosive:
 - a. Temperature: 20 degrees F to 104 degrees F.
 - b. Relative Humidity: 0 to 100 percent, rain.
 - c. Corrosive Environment: Hydrogen sulfide gas.
 - d. NEC Classification: As noted on Drawings.
7. Outside, Hazardous:
 - a. Temperature: 20 degrees F to 104 degrees F.
 - b. Relative Humidity: 0 to 100 percent, rain.
 - c. NEC Classification: As noted on Electrical Drawings.

1.07 SEQUENCING AND SCHEDULING

- A. Activity Completion: The following is a list of key activities and their completion criteria:
 1. Shop Drawings: Reviewed and approved.
 2. Quality Control Submittals: Reviewed and accepted.
 3. Hardware Delivery: Hardware delivered to Site.
 4. PAT: Completed and required test documentation accepted.
- B. PIC Substantial Completion: When Engineer issues Certificate of Substantial Completion.
 1. Prerequisites:
 - a. All PIC Submittals have been completed.
 - b. PIC has successfully completed PAT.
 - c. Owner training plan is on schedule.
 - d. All spares, expendables, and test equipment have been delivered to Owner.
- C. PIC Acceptance: When Engineer issues a written notice of Final Payment and Acceptance.
 1. Prerequisites:
 - a. Certificate of Substantial Completion issued for PIC.
 - b. Punch-list items completed.
 - c. Final revisions to O&M manuals accepted.
 - d. Maintenance service agreements for PIC accepted by Owner.

- D. Prerequisite Activities and Lead Times: Do not start the following key Project activities until the prerequisite activities and lead times listed below have been completed and satisfied:

| <u>Activity</u> | <u>Prerequisites and Lead Times</u> |
|--|---|
| Submittal reviews by Engineer | Engineer acceptance of Submittal breakdown and schedule. |
| Hardware purchasing, fabrication, and assembly | Associated Shop Drawing Submittals completed. |
| Shipment | Completion of PIC Shop Drawing Submittals and preliminary O&M manuals. |
| Owner Training | Owner training plan completed |
| PAT | Startup, Owner training, and PAT procedures completed; notice 4 weeks prior to start. |

PART 2 PRODUCTS

2.01 GENERAL

- A. PIC functions as shown on Drawings and as required for each loop. Furnish equipment items as required. Furnish all materials, equipment, and software, necessary to effect required system and loop performance.
- B. First Named Manufacturer: PIC design is based on first named manufacturers of equipment and materials.
1. If an item is proposed from other than first named manufacturer, obtain approval from Engineer for such changes in accordance with Article Submittals.
 2. If using proposed item requires other changes, provide work and equipment to implement these changes. Changes that may be required include, but are not limited to: different installation, wiring, raceway, enclosures, connections, isolators, intrinsically safe barriers, software, and accessories.
- C. Like Equipment Items:
1. Use products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.

2. Implement all same or similar functions in same or similar manner. For example, control logic, sequence controls, and display layouts.

2.02 PROGRAMMABLE LOGIC CONTROLLERS, FIELD BUS, AND NETWORK, COMPONENTS

- A. The use of programmable logic controllers is not permitted on this Project.

2.03 NAMEPLATES AND TAGS

- A. Panel Nameplates: Enclosure identification located on the enclosure face.

1. Location and Inscription: As shown.
2. Materials: Laminated plastic attached to panel with stainless steel screws.
3. Letters: 1/2-inch white on black background, unless otherwise noted.

- B. Component Nameplates—Panel Face: Component identification located on panel face under or near component.

1. Location and Inscription: As shown.
2. Materials: Laminated plastic attached to panel with stainless steel screws.
3. Letters: 3/16-inch white on black background, unless otherwise noted.

- C. Component Nameplates—Back of Panel: Component identification located on or near component inside of enclosure.

1. Inscription: Component tag number.
2. Materials: Adhesive backed, laminated plastic.
3. Letters: 3/16-inch white on black background, unless otherwise noted.

- D. Legend Plates for Panel Mounted Pushbuttons, Lights, and Switches.

1. Inscription: Refer to:
 - a. Table under paragraph Standard Pushbutton Colors and Inscriptions.
 - b. Table under paragraph Standard Light Colors and Inscriptions.
 - c. P&IDs in Drawings.
2. Materials: Stainless steel, keyed legend plates. Secured to panel by mounting nut for pushbutton, light, or switch.
3. Letters: Black on gray or white background.

- E. Service Legends: Component identification nameplate located on face of component.
 - 1. Inscription: As shown.
 - 2. Materials: Adhesive backed, laminated plastic.
 - 3. Letters: 3/16-inch white on black background, unless otherwise noted.
- F. Nametags: Component identification for field devices.
 - 1. Inscription: Component tag number.
 - 2. Materials: 16-gauge, Type 304 stainless steel.
 - 3. Letters: 3/16-inch imposed.
 - 4. Mounting: Affix to component with 16- or 18-gauge stainless steel wire or stainless steel screws.

2.04 I&C COMPONENTS

- A. Components for Each Loop: Major components for each loop are listed below. Furnish all equipment that is necessary to achieve required loop performance.
- B. Component Specifications: Generalized specifications for each type of component.
- C. L8 Level Switch, Mercury:
 - 1. General:
 - a. Function: Actuate contact at preset liquid level.
 - b. Type: Direct-acting float with enclosed mercury switch and integral cable.
 - 2. Service (Liquid): Wastewater.
 - 3. Performance:
 - a. Setpoint: As noted.
 - b. Differential: 2.5 inches, maximum.
 - c. Temperature: 0 degree F to 160 degrees F.
 - 4. Features:
 - a. Entire Assembly: Watertight and impact-resistant.
 - b. Float Material and Size:
 - 1) Polypropylene body; 4.5-inch diameter and 6-inch length.
 - c. Cable:
 - 1) Combination support and signal.
 - 2) Length as noted or as necessary per mounting requirements.
 - 3) PVC cable jacket.

- d. Mounting: Pipe, unless otherwise noted.
- 1) Pipe Mounting:
 - a) Cable clamp, suitable for connection to 1-inch pipe.
 - b) Pipe-to-wall bracket, suitable for connection to 1-inch pipe.
 - 2) Suspended Mounting (internal weights): If noted.
 - a) Wall mounting bracket, unless otherwise noted.
 - 3) Anchor Mounting Kit: If noted.
 - a) Compatible with pipe-mounted floats.
 - b) 15-pound vinyl-coated cast iron anchor.
 - c) 1/8-inch, Type 316 stainless steel vinyl-coated wire rope.
 - d) Stainless steel cable clips.
5. Signal Interface:
- a. Switch Type: Mercury tilt.
 - b. Switch Contacts:
 - 1) Isolated, rated 4.5A continuous at 120V ac.
 - 2) Form C contact (one NO, one NC), unless otherwise noted.
6. Accessories: As noted.
7. Manufacturers and Products:
- a. Anchor Scientific; Roto-Float, S40-NC, no exceptions.
8. Schedule:

| Tag Number | Service Description | Initial State/Span (Exact setpoints TBD during construction) | Remarks |
|------------|---------------------|---|-----------------|
| LSL-1-1 | Wet Well | Elevation 613.5, falling | Normally closed |
| LSM-1-1 | Wet Well | Elevation 616, rising | Normally closed |
| LSHH-2-1 | Start Fill Mode | Elevation 620, rising | Normally closed |
| LSL-2-1 | Stop EQ Pump | Elevation 617, falling | Normally closed |
| LSL-2-2 | Start Drain Mode | Elevation 614, rising | Normally closed |
| LSH-2-2 | Stop Drain Mode | Elevation 615.5, falling | Normally closed |
| LSHH-2-2 | Stop Drain Mode | Elevation 659.5, rising | Normally closed |
| | Stop Fill Mode | | Normally closed |
| | | | Normally closed |
| | | | Normally closed |

D. L42 Level Element/Transmitter, Submersible, Wastewater:

1. General:
 - a. Function: Measure and transmit signal proportional to level.
 - b. Type:
 - 1) Totally submersible pressure sensor (loop powered).
 - 2) Suitable for wastewater.
 - c. Parts: Sensor, interconnecting cable, other parts as noted.
2. Service:
 - a. Fluid: Wastewater, unless otherwise noted.
3. Performance:
 - a. Process Range:
 - 1) As noted.
 - 2) Provide fixed factory range such that noted process range is between 40 percent and 80 percent of fixed factory range.
 - b. Accuracy: 0.25 percent of full scale.
 - c. Temperature, Operating: 0 degrees F to plus 176 degrees F.
4. Features:
 - a. Sensor:
 - 1) Silicon pressure-sensing element.
 - 2) External Diaphragm: Flush type, coated with fluoro-polymer.
 - 3) Type 316 stainless steel pressure module assembly, unless otherwise noted.
 - 4) NEMA 6/IP 68 rating (submersible).
 - 5) Temperature compensation.
 - 6) Double bird cage design.
 - 7) Loop powered, 9-30V dc.
 - b. Interconnecting Cable:
 - 1) Length: As required.
 - 2) Polyurethane sheathed, unless otherwise noted.
 - 3) Kevlar strain relief cord.
 - 4) Integral vent tube.
 - c. Sensor Termination Enclosure: Required.
 - 1) Enclosure: NEMA 4X.
 - 2) Houses such noted items as desiccant vent, filter, microfilter, aneroid bellows, terminal blocks for wire terminations.
 - 3) 2-Inch Pipe Mounting Kit: If noted.
 - d. Accessories:
 - 1) Desiccant Module: Required.
 - 2) Spare Desiccant Modules: Required.
 - a) Quantity: Two per instrument.
 - 3) Cable Hanger, Kellems Type Grip: Required.

- 4) Lightning Protection:
 - a) Internal (protects against water lightning strike):
If noted.
 - b) External (protects 4 mA to 20 mA dc output):
Required.
- 5) Anchor Assembly: If noted.
 - a) Marine anchor, clamps, Type 316 stainless steel cable or chain, length as required, nominally 3 feet longer than interconnecting cable.
5. Signal Interface: 4 mA to 20 mA dc output, for load impedance of 0 ohm to 750 ohms, minimum for 24V dc supply without load adjustment.
6. Certification(s): FM Rated Class I, Div 1, Groups A, B, C, and D.
7. Manufacturers: Dwyer, Series PBLT2/PBLTX (intrinsically safe).
8. Schedule:

| Tag Number | Service Description | State/Span | Remarks |
|------------|---------------------|------------|---|
| LE/LIT-1-1 | Wet Well | 0-27 Ft | Class 1, Div 1 Groups A, B, C, D Rated |
| LE/LIT-2-1 | EQ Tank | 0-24 Ft | Class 1, Div 1 Groups A, B, C, D Rated |

E. P4 Pressure Gauge:

1. General:
 - a. Function: Local pressure indication.
 - b. Type: Bourdon tube element.
2. Performance:
 - a. Scale Range: As noted.
 - b. Accuracy: Plus or minus 0.50 percent of full scale.
3. Features:
 - a. Dial: 4-1/2-inch diameter.
 - b. Pointer Vibration Reduction: Required, unless otherwise noted.
Use the following method:
 - 1) Liquid filled gauge front, unless otherwise noted.
 - a) Glycerine fill, unless otherwise noted.
 - c. Case Material: Black thermoplastic, unless otherwise noted.
 - d. Materials of Wetted Parts (including element, socket/process connection, throttling device (if specified) and secondary components):
 - 1) Stainless steel, unless otherwise noted.
 - e. Material of Clamps, Bolts, Rings, Nuts: Type 316 stainless steel.
 - f. Pointer: Adjustable by removing ring and window.

- g. Window: Glass or acrylic, unless otherwise noted.
- h. Threaded reinforced polypropylene front ring.
- i. Case Type: Solid front with blow-out back.
- 4. Process Connection:
 - a. Mounting: Lower stem, unless otherwise noted.
 - b. Size: 1/2-inch MNPT, unless otherwise noted.
- 5. Accessories:
 - a. Throttling Device: Required, unless otherwise noted.
 - 1) Type suitable for the intended service.
 - 2) Install in gauge socket bore.
- 6. Factory Assembly:
 - a. Where shown on the Drawings, provide factory assembled unit with annular pressure seal (Component Code P15).
 - b. Provide a liquid fill system.
 - 1) Glycerin, unless otherwise noted.
 - c. Unit shall be factory assembled by the manufacturer.
- 7. Manufacturers and Products:
 - a. Ashcroft; Duragauge Model 1259/Model, 1279/Model, 1279 PLUS!
 - b. Approved equal.
- 8. Schedule:

| Tag Number | Service Description | State/Span | Remarks |
|------------|---------------------|------------|---------|
| PI-1-1 | Pump 1 | 0-60 psi | |
| PI-2-1 | Pump 2 | 0-60 psi | |

F. P6 Pressure Seal, Annular:

- 1. General:
 - a. Function:
 - 1) Sense pressure in a process line and transfer to pressure monitoring device.
 - 2) Protect attached pressure monitoring device from sludge or slurry.
 - b. Type: Annular fluid-filled device that senses pressure through flexible sleeve around full pipe circumference.
- 2. Performance:
 - a. Operating Conditions: Suitable for line pressures up to pipe flange rating.
- 3. Features:
 - a. Construction:
 - 1) Offline: Threaded.
 - b. Materials:
 - 1) Body: Carbon steel, unless otherwise noted.

- 2) Flanges (where applicable): Carbon steel, unless otherwise noted.
- 3) Flexible Sleeve: Buna-N, unless otherwise noted.
- 4) Fill Fluid: Ethylene glycol/water or propylene glycol, unless otherwise noted.
- c. Factory Filled System:
 - 1) Filled and assembled with pressure monitoring device(s).
 - 2) Coordinate attached pressure monitoring device(s) with system integrator. Seal vendor's standard pressure monitoring device(s) only acceptable if it meets specification of the related pressure monitoring device.
4. Process Connections:
 - a. Mounting: In-line or offline, as noted or shown.
 - b. Pipe Size:
 - 1) In-line: As noted or shown.
 - 2) Offline: 2 inches, unless otherwise noted.
 - c. Connections:
 - 1) In-line, Full-faced through-bolted: ASME B16.5, 150-pound flanges.
 - 2) In-line, Wafer style: Compatible with Classes 150/300 flange drilling.
 - 3) Offline: Female NPT Threaded, unless otherwise noted.
5. Factory Assembly:
 - a. Where shown on the Drawings, provide factory assembled unit with annular pressure seal (Component Code P15) and pressure gauge (Component Code P4).
 - b. Provide a liquid fill system: Glycerin, unless otherwise noted.
 - c. Unit shall be factory assembled by the manufacturer.
6. Manufacturers and Products:
 - a. Ashcroft Type 80 (wafer) or Type 81 (bolt thru).
 - b. Approved Equal.

2.05 ~~RELOCATION OF EXISTING~~ MISSION SYSTEM

- A. Includes all work required for the provision and signal interfacing to a Mission System as specified and shown.
- B. Provide cabling between the antenna and the Mission System. Locate antenna as required to provide reliable cellular signal.
- C. Provide power and transmit signals to the Mission System as shown on the Drawings.
- D. New remote terminal unit controller, antenna, special cabling, and parts shall be provided by Mission Communications. Model shall be MyDro M850. No substitutions allowed.

E. PIC Supplier shall procure the Mission System and install it inside control panel CP-PDPS. PIC Supplier shall coordinate with Mission Systems and include all activation, commissioning, and startup costs.

1. Mission Communications Contact Information:

a. Matt Crousillac, National Sales Manager.

b. E-mail: mattc@123mc.com

c. Address: 3060 Business Park Dr. Suite C, Norcross GA 30071.

d. Phone: (877) 993-1911.

~~A. Includes all work required to relocate the existing Mission system as specified and shown.~~

~~B. Relocate the existing Mission System from the side of the existing control panel to the inside of the new control panel, CP-MPS. Provide new cabling between the existing antenna and the relocated Mission system.~~

~~C. Provide power and transmit signals to the Mission System as shown on the Drawings.~~

~~D. New cabling and parts shall be provided by Mission Communication.~~

~~1. Contact Information:~~

~~a. Address: 3060 Business Park Dr. Suite C, Norcross GA 30071.
Phone: (877) 993-1911.~~

2.06 CONTROL PANELS

A. Panels: Provide the following panels:

1. Tag Number: CP-PDPS, Parkway Dr PS Pump Control Panel.
 - a. Input Power: 480V ac.
 - b. Material: Type 316 stainless steel.
 - c. NEMA Rating: 4X.
 - d. Interior swingout panel.
 - e. As a minimum, provide the following within the control panel CP-PDPS:
 - 1) Main circuit breaker, analog pump controller, motor starters, pump thermal and moisture protection modules furnished by the Submersible Pump Supplier, terminal blocks for all incoming or outgoing conductors, control power transformer, panel heater, 480V surge suppressor, 120V surge suppressor, relays, and the relocated Mission System and accessories.
2. Tag Number: CP-EQ, Parkway Dr PS EQ Control Panel
 - a. Input Power: 120V ac.
 - b. Material: Type 304 stainless steel.

- c. NEMA Rating: 4X.
- d. As a minimum, provide the following within the control panel CP-EQ: Main circuit breaker, thermostatically controlled heater, surge suppressor, terminal blocks, relays.

B. Operator Controls and Indications:

- 1. For CP-PDPS:
 - a. As a minimum, provide the following operator controls and indications on the panel face (all components shall be rated NEMA 4X):
 - 1) HAND/OFF/AUTO selector switch, one per pump.
 - 2) ON status indicating light, one per pump, green lens.
 - 3) Fail Alarm light, one per pump.
 - 4) High temperature light, one per pump.
 - 5) Seal failure, one per pump.
 - 6) Elapsed time meter, one per pump.
 - 7) Elapsed time meter, both pumps.
 - 8) Alarm silence pushbutton.
 - 9) RESET pushbutton, one per pump.
 - 10) Horn disable selector switch.
 - 11) Trouble light selector switch.
 - 12) High level beacon.
- 2. For CP-EQ:
 - a. As a minimum, provide the following operator controls and indications on the panel face (all components shall be rated NEMA 4X):
 - 1) OPEN/CLOSE/AUTO selector switch, one per drain valve.
 - 2) OPEN/CLOSE/AUTO selector switch, solenoid valve.
 - 3) OPENED status indicating light, one per drain valve (green lens).
 - 4) OPENED status indicating light, solenoid valve (green lens).
 - 5) CLOSED status indicating light, one per drain valve (red lens).
 - 6) FILL mode indicating light.
 - 7) RESET Fill mode pushbutton.
 - 8) DRAINING mode indicating light.
 - 9) PAUSE Drain mode pushbutton.
 - 10) EQ Tank Level LED Display.

C. External Interfaces:

- 1. Signal Interface of the Mission System:
 - a. Accept the following discrete inputs:
 - 1) AC Power Fail.

- 2) Wet well high level (based on the analog instrument).
- 3) EQ tank high level.
- 4) EQ pump ON status.
- 5) Mission System communications failure.

D. Functional Requirements:

1. For CP-PDPS: Provide HAND/OFF/AUTO control modes as follows:
 - a. HAND: When the pump HAND/OFF/AUTO hand switch is in HAND, the pump runs continuously.
 - b. OFF: When the pump HAND/OFF/AUTO hand switch is in OFF, the pump is off.
 - c. AUTO: When the pump HAND/OFF/AUTO hand switch is in AUTO, the pump is controlled by the Mercoid analog pump controller based off of level.
 - a) Pumps operate in a LEAD/LAG configuration. The analog pump controller provides automatic alternation of the LEAD and LAG pumps.
 - b) Pumps start and stop based on level (initial settings).
 - (1) LEAD ON elevation – 616 feet.
 - (2) LAG ON elevation – 616.5 feet.
 - (3) Pumps OFF elevation – 612.5 feet.
 - d. Provide hard wired backup control of the two wetwell pumps using floats LSM-1-1 and LSL-1-1. Start one pump when float LSM-1-1 has been active for a preset time delay and then start the second pump after a preset time delay after the first pump starts. Stop both pumps when float LSL-1-1 has been active for a preset time delay.
 - e. Pump Interlocks: In any mode of operation, DISABLE the pump on HIGH motor temperature. The pump shall not be allowed to resume operation until the RESET pushbutton is pressed.
 - f. Upon resumption of power after an outage, pumps shall resume operation without manual intervention. (Pumps shall reset automatically, not manually.)
2. For CP-EQ:
 - a. Provide Open/Close/Auto control for each valve as follows:
 - 1) In Open: When the valve Open/Close/Auto hand switch is in the Open position, the valve is commanded to open.
 - 2) In Closed: When the valve Open/Close/Auto hand switch is in the Close position, the valve is commanded to close.
 - 3) In Auto: When the valve Open/Close/Auto hand switch is in the Auto position, the valve functions per the tank filling and draining sequence described below.

- b. There will be two modes for the EQ Tank: Tank Filling and Tank Draining. If the tank is not in Tank Fill Mode, the tank shall be in Tank Drain Mode.
- c. Tank Filling Mode:
 - 1) The tank filling mode is triggered when float LSHH-2-1 has been active for a preset time delay (initial setting, 60 seconds).
 - 2) Once the tank filling mode has been triggered, light up the FILL mode light AND transmit a start command (closed dry contact output) to the EQ Tank Engine Control Panel (LCP-2-1). Remove the run command when float LSL-2-1 has been active for a preset time delay (initial setting 30 seconds). Restart the EQ Pump (Transmit a closed dry contact output to LCP-2-1) once LSHH-2-1 activates for a preset time (initial setting, 30 seconds).
 - 3) Open SV-2-1 when LSL-2-1 has been active for a preset time delay. Close SV-2-1 when LSHH-2-1 activates.
 - 4) When in Tank Fill mode, transmit a close command to the EQ Drain Valves (FV-2-1 and FV-2-2).
 - 5) Tank Fill mode is stopped when float LSHH-2-2 has been active for a preset time delay (initial setting, 60 seconds), if the tank has been in Tank Fill mode for longer than a preset time (initial settings, 12 hours), or if the RESET Tank Fill mode pushbutton is pressed.
- d. Tank Draining Mode: In Tank Drain Mode, transmit an open command to each EQ Drain Valve (FV-2-1 and FV-2-2) when float LSL-2-2 is active for a preset time delay. Close the valves when float LSH-2-2 is active for a preset time delay.

E. Special Requirements:

- 1. Mission Systems RTU:
 - a. Install the existing Mission System including any accessories inside control panel CP-PDPS.
 - b. Furnish and install all other interface wiring, terminals, circuit breakers, etc., required to interface and power the Mission System from the control panel.
 - c. Coordinate space requirements and installation requirements with Mission.
- 2. Provide either intrinsically safe devices or explosion proof devices for all components in classified hazardous locations. As a minimum, provide intrinsically safe devices for the following instruments:
 - a. All level transducers. Provide suitable barrier meeting the entity parameters of the device.

3. Provide intrinsically safe relays in the control panels for signals entering panel from classified area in accordance with the NEC. As a minimum, intrinsic safety barriers shall be used for all level float signals, thermal switch, and moisture sensor circuits. Intrinsically safe relays are not required if field device is explosion proof.
4. Provide the Mercoïd analog pump controller to provide automatic control of the pump station wetwell pumps.
 - a. Manufacturer and Product: Dwyer MPC Mercoïd pump controller, no exceptions.
5. Programmable logic controllers (PLCs) or similar devices are not acceptable. Functional requirements shall be met without the use of PLCs or specialized programming or software.
6. Panel mount human machine interfaces (HMIs) or similar devices are not acceptable.

2.07 ELECTRICAL REQUIREMENTS

- A. In accordance with Division 26, Electrical.
- B. I&C and electrical components, terminals, wires, and enclosures: UL recognized or UL listed.
- C. Wires within Enclosures:
 1. ac Circuits:
 - a. Type: 300-volt, Type MTW stranded copper.
 - b. Size: For current to be carried, but not less than 18 AWG.
 2. Analog Signal Circuits:
 - a. Type: 300-volt stranded copper, twisted shielded pairs.
 - b. Size: 18 AWG, minimum.
 3. Other dc Circuits.
 - a. Type: 300-volt, Type MTW stranded copper.
 - b. Size: For current carried, but not less than 18 AWG.
 4. Special Signal Circuits: Use manufacturer's standard cables.
 5. Wire Identification: Numbered and tagged at each termination.
 - a. Wire Tags: Machine printed, heat shrink.
 - b. Manufacturers:
 - 1) Brady PermaSleeve.
 - 2) Tyco Electronics.
- D. Wires entering or leaving enclosures, terminate and identify as follows:
 1. Analog and discrete signal, terminate at numbered terminal blocks.
 2. Special signals, terminated using manufacturer's standard connectors.
 3. Identify wiring in accordance with Section 26 05 05, Conductors.

E. Terminal Blocks for Enclosures:

1. Quantity:
 - a. Accommodate present and spare indicated needs.
 - b. Wire spare PLC I/O points to terminal blocks.
 - c. One wire per terminal for field wires entering enclosures.
 - d. Maximum of two wires per terminal for 18-WG wire for internal enclosure wiring.
 - e. Spare Terminals: 20 percent of all connected terminals, but not less than 10 per terminal block.
2. General:
 - a. Connection Type: Screw compression clamp.
 - b. Compression Clamp:
 - 1) Complies with DIN-VDE 0611.
 - 2) Hardened steel clamp with transversal groves that penetrate wire strands providing a vibration-proof connection.
 - 3) Guides strands of wire into terminal.
 - c. Screws: Hardened steel, captive and self-locking.
 - d. Current Bar: Copper or treated brass.
 - e. Insulation:
 - 1) Thermoplastic rated for minus 55 to plus 110 degree C.
 - 2) Two funneled shaped inputs to facilitate wire entry.
 - f. Mounting:
 - 1) Standard DIN rail.
 - 2) Terminal block can be extracted from an assembly without displacing adjacent blocks.
 - 3) End Stops: Minimum of one at each end of rail.
 - g. Wire preparation: Stripping only permitted.
 - h. Jumpers: Allow jumper installation without loss of space on terminal or rail.
 - i. Marking System:
 - 1) Terminal number shown on both sides of terminal block
 - 2) Allow use of preprinted and field marked tags.
 - 3) Terminal strip numbers shown on end stops.
 - 4) Mark terminal block and terminal strip numbers as shown on Panel Control Diagrams and Loop Diagrams.
 - 5) Fuse Marking for Fused Terminal Blocks: Fuse voltage and amperage rating shown on top of terminal block.
 - j. Test Plugs: Soldered connections for 18 AWG wire.
 - 1) Pin Diameter: 0.079 inch.
 - 2) Manufacturer and Product:
 - a) Entrelec; Type FC2.
 - b) Weidmuller.
 - c) Allen-Bradley.

3. Terminal Block, General-Purpose:
 - a. Rated Voltage: 600V ac.
 - b. Rated Current: 30 amp.
 - c. Wire Size: 22 AWG to 10 AWG.
 - d. Rated Wire Size: 10 AWG.
 - e. Color: Grey body.
 - f. Spacing: 0.25 inch, maximum.
 - g. Test Sockets: One screw test socket 0.079-inch diameter.
 - h. Manufacturers and Products:
 - 1) Weidmuller; 1020100000 with 0280600000.
 - 2) Entrelec; Type M4/6.T.
 - 3) Phoenix Contact.
4. Terminal Block, Ground:
 - a. Wire Size: 22 AWG to 12 AWG.
 - b. Rated Wire Size: 12 AWG.
 - c. Color: Green and yellow body.
 - d. Spacing: 0.25 inch, maximum.
 - e. Grounding: Ground terminal blocks electrically grounded to the mounting rail.
 - f. Manufacturers and Products:
 - 1) Weidmuller; 1010100000.
 - 2) Entrelec; Type M4/6.P.
 - 3) Phoenix Contact.
5. Terminal Block, Blade Disconnect Switch:
 - a. Rated Voltage: 600V ac.
 - b. Rated Current: 10-amp.
 - c. Wire Size: 22 AWG to 12 AWG.
 - d. Rated Wire Size: 12 AWG.
 - e. Color: Grey body, orange switch.
 - f. Spacing: 0.25 inch, maximum.
 - g. Manufacturers and Products:
 - 1) Weidmuller; 7910210000.
 - 2) Entrelec; Type M4/6.SN.T.
 - 3) Phoenix Contact.
6. Terminal Block, Diode:
 - a. Rated Voltage: 24V dc.
 - b. Rated Current: 30 ma.
 - c. Wire Size: 16 AWG.
 - d. Manufacturers and Products:
 - 1) Weidmuller.
 - 2) Phoenix Contact ST-IN.
7. Terminal Block, Fused, 24V dc:
 - a. Rated Voltage: 600V dc.
 - b. Rated Current: 16-amp.
 - c. Wire Size: 22 AWG to 10 AWG.
 - d. Rated Wire Size: 10 AWG.

- e. Color: Grey body.
 - f. Fuse: 0.25 inch by 1.25 inches.
 - g. Indication: LED diode 24V dc.
 - h. Spacing: 0.512 inch, maximum.
 - i. Manufacturers and Products:
 - 1) Weidmuller 1880410000.
 - 2) Entrelec; Type M10/13T.SFL.
 - 3) Phoenix Contact.
8. Terminal Block, Fused, 120V ac:
- a. Rated Voltage: 600V ac.
 - b. Rated Current: 25 amps.
 - c. Wire Size: 22 AWG to 10 AWG.
 - d. Rated Wire Size: 10 AWG.
 - e. Color: Gray body.
 - f. Fuse: 0.25 inch by 1.25 inches.
 - g. Indication: Neon lamp, 110V ac.
 - h. Leakage Current: 1.8 mA, maximum.
 - i. Spacing: 0.512 inch, maximum.
 - j. Manufacturer and Product:
 - 1) Entrelec; Type ML10/13.SFL.
 - 2) Weidmuller 1880420000.
 - 3) Phoenix Contact.
9. Terminal Block, Fused, 120V ac, High Current:
- a. Rated Voltage: 600V ac.
 - b. Rated Current: 35 amps.
 - c. Wire Size: 18 AWG to 8 AWG.
 - d. Rated Wire Size: 8 AWG.
 - e. Color: Gray.
 - f. Fuse: 13/32 inch by 1.5 inches.
 - g. Spacing: 0.95 inch, maximum.
 - h. Manufacturer and Product:
 - 1) Entrelec; Type MB10/24.SF.
 - 2) Weidmuller; 7940029428.
 - 3) Phoenix Contact.

F. Grounding of Enclosures:

- 1. Furnish isolated copper grounding bus for signal and shield ground connections.
- 2. Ground bus grounded at a common signal ground point in accordance with National Electrical Code requirements.
- 3. Single Point Ground for Each Analog Loop:
 - a. Locate at dc power supply for loop.
 - b. Use to ground wire shields for loop.
 - c. Group and connect shields in following locations:
 - 1) Locate signal ground at dc power supply for loop.

- 2) Use to ground wire shields for loop.
4. Ground terminal block rails to ground bus.

G. Analog Signal Isolators:

1. General:
 - a. Function: Furnish signal isolation for analog signals that are sent from one enclosure to another. Do not wire in series instruments on different panels, cabinets, or enclosures.
 - b. Type:
 - 1) Solid state with external power supply.
 - 2) Three-way isolation of the input signal, output signal, and external power supply.
2. Performance:
 - a. Isolation:
 - 1) Three-way isolation between input, output, and power circuits for common mode voltages up to 250V ac, or 354V dc of ground, on a continuous basis.
 - 2) Able to withstand 1,500V ac dielectric strength test for 60 seconds without breakdown.
 - b. Output Ripple: Less than plus or minus 0.1 percent of maximum output span.
 - c. Accuracy: Plus or minus 0.1 percent of output span.
 - d. Ambient Temperature, Operating: Minus 13 degrees F to plus 149 degrees F.
3. Features:
 - a. Zero and span trim adjustments using 15-turn potentiometers.
 - b. Calibration independent of load.
 - c. Compact dimensions with width less than or equal to 6.2 mm.
 - d. Power supply possible through foot element.
4. Signal Interface:
 - a. Input:
 - 1) 4 mA to 20 mA dc.
 - 2) Impedance: 50 ohms.
 - b. Output:
 - 1) 4 mA to 20 mA dc.
 - 2) Drives output load impedance up to 500 ohms independent of supply voltage to isolator.
5. Enclosure:
 - a. NEMA 1, unless otherwise noted.
 - b. Mounting: DIN Rail, unless otherwise noted.
6. Power: 24V dc.
7. Manufacturer:
 - a. Phoenix Contact MINI MCR.
 - b. Weidmuller.
 - c. Or approved equal.

H. Intrinsically Safe Circuits:

1. Intrinsically safe circuits will conform to NFPA 70 Standards:
 - a. All terminal strips, electrical raceways, and cable trays will be color coded light blue.
 - b. All intrinsically safe circuits will maintain appropriate separation/isolation from nonintrinsically safe circuits.
 - c. All intrinsically safe conduit will be marked to clearly indicate that the conduit contains intrinsically safe circuits.
 - d. Grounding as specified by the intrinsically safe barrier manufacturer will be installed in conformance with manufacturer specifications.

I. Intrinsic Safety Barriers:

1. Intrinsically Safe Relays: Monitor discrete signals that originate in hazardous area and are used in a safe area.
 - a. Manufacturer and Product: MTL, Inc.; Series MTL 5000.
2. Intrinsically Safe Barriers: Interface analog signals as they pass from hazardous area to safe area.
 - a. Manufacturer and Product: MTL, Inc.; Series MTL 5000.

J. Power Distribution within 120V ac Panels:

1. Feeder Circuits:
 - a. One or more 120V ac, 60-Hz feeder circuits as shown on Drawings.
 - b. Make provisions for feeder circuit conduit entry.
 - c. Furnish terminal board for termination of wires.
2. Power Panel: Furnish main circuit breaker and a circuit breaker on each individual branch circuit distributed from power panel.
 - a. Locate to provide clear view of and access to breakers when door is open.
 - 1) Breaker Sizes: Coordinate such that fault in branch circuit will blow only branch breaker, but not trip main breaker.
 - a) Branch Circuit Breakers: 15 amps at 250V ac.
 - 2) Provide UL 489 listed breakers.
 - 3) Breaker Manufacturers and Products:
 - a) Square D; Multi 9 Series.
 - b) Allen-Bradley; 1489-A Series.
 - c) Or approved equal.
3. Circuit Wiring: P&IDs and Control Diagrams on Drawings show function only. Use following rules for actual circuit wiring:
 - a. Devices on Single Circuit: 20, maximum.

- b. Multiple Units Performing Parallel Operations: To prevent failure of any single branch circuit from shutting down entire operation, do not group all units on same branch circuit.
 - c. Branch Circuit Loading: 12 amperes continuous, maximum.
 - d. Panel Lighting and Service Outlets: Put on separate 15-amp, 120V ac branch circuit.
 - e. Provide 120V ac plugmold for panel components with line cords.
- K. Power Distribution within Panels with Three-Phase Power Supplies:
- 1. Interlock main circuit breaker with panel door.
 - a. Mount logic controls, branch circuit breakers, overload reset switches, and other control circuit devices.
 - b. Mount operator controls and indications on front access door.
 - 2. Circuit Breakers:
 - a. In accordance with Section 26 05 04, Basic Electrical Materials and Methods.
 - b. In accordance with NEMA AB 1.
 - c. Breakers, except Motor Branch Breakers: Molded case thermal magnetic.
 - d. 42,000-ampere RMS symmetrical rating, minimum at 480 volts, unless otherwise specified in package system equipment specification sections.
 - e. Tripping: Indicate with operator handle position.
 - 3. Magnetic Motor Starters:
 - a. In accordance with Section 26 20 00, Low Voltage AC Induction Motors.
 - b. Full voltage, NEMA ICS 2, Class A, Size 2.
 - c. Include three-pole bimetallic or eutectic alloy thermal overload relays sized for each motor.
 - d. Manual reset type with reset button mounted on inner swing out panel (panel deadfront).
 - 4. Motor Control: 120V ac (except intrinsically safe circuits where applicable).
 - a. Power Control Transformer:
 - 1) Sufficient capacity to serve connected load, including 200VA for duplex outlet plus 100VA (minimum).
 - 2) Limit voltage variation to 15 percent during contact pickup.
 - 3) Fuse one side of secondary winding and ground the other.
 - 4) Furnish primary winding fuses in ungrounded conductors.
 - 5. Power Monitoring Relay:
 - a. Protect three-phase equipment from single phasing, phase imbalance, or phase reversal.
 - b. Separate, isolated contact outputs to stop motors and activate alarm light during abnormal conditions.

- c. Transient Voltage Protection: 10,000 volts.
- d. Manufacturer and Product: TBD.
- 6. Power Distribution Blocks: Furnish to parallel feed tap on branch circuit protective devices.
- 7. Terminations for Power Conductors: Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

L. Signal Distribution:

- 1. Within Panels: 4 mA to 20 mA dc signals may be distributed as 1 to 5V dc.
- 2. Outside Panels: Isolated 4 mA to 20 mA dc only.
- 3. All signal wiring twisted in shielded pairs.

M. Signal Switching:

- 1. Use dry circuit type relays or switches.
- 2. No interruption of 4 mA to 20 mA loops during switching.
- 3. Switching Transients in Associated Signal Circuit:
 - a. 4 mA to 20 mA dc Signals: 0.2 mA, maximum.
 - b. 1 to 5V dc Signals: 0.05V, maximum.

N. Relays:

- 1. General:
 - a. Relay Mounting: Plug-in type socket.
 - b. Relay Enclosure: Furnish dust cover.
 - c. Socket Type: Screw terminal interface with wiring.
 - d. Socket Mounting: Rail.
 - e. Provide holddown clips.
 - f. Temperature Rating: Minus 10 to 140 degrees F.
- 2. Signal Switching Relay:
 - a. Type: Dry circuit.
 - b. Contact Arrangement: 2 Form C contacts.
 - c. Contact Rating: 5 amps at 28V dc or 120V ac.
 - d. Contact Material: Gold or silver.
 - e. Coil Voltage: As noted or shown.
 - f. Coil Power: 0.9 watt (dc), 1.2VA (ac).
 - g. Expected Mechanical Life: 10,000,000 operations.
 - h. Expected Electrical Life at Rated Load: 100,000 operations.
 - i. Indication Type: Neon or LED indicator lamp.
 - j. Seal Type: Hermetically sealed case.
 - k. Manufacturer and Product:
 - 1) Weidmuller; Series RCM.
 - 2) Idec.
 - 3) Allen-Bradley.

3. Control Circuit Switching Relay, Nonlatching:
 - a. Type: Compact general purpose plug-in.
 - b. Contact Arrangement: 3 Form C contacts.
 - c. Contact Rating: 10A at 28V dc or 120V ac, and 6.6A at 240V ac.
 - d. Contact Material: Silver cadmium oxide alloy.
 - e. Coil Voltage: As noted or shown.
 - f. Coil Power: 1.8 watts (dc), 2.7VA (ac).
 - g. Expected Mechanical Life: 10,000,000 operations.
 - h. Expected Electrical Life at Rated Load: 100,000 operations.
 - i. Indication Type: Neon or LED indicator lamp.
 - j. Push-to-test button.
 - k. Manufacturer and Product:
 - 1) Weidmuller; Riderseries II.
 - 2) Idec.
 - 3) Allen-Bradley.
4. Control Circuit Switching Relay, Latching:
 - a. Type: Dual coil magnetic latching relay.
 - b. Contact Arrangement: 2 Form C contacts.
 - c. Contact Rating: 10A at 28V dc or 120V ac.
 - d. Contact Material: Silver cadmium oxide alloy.
 - e. Coil Voltage: As noted or shown.
 - f. Coil Power: 2.7 watts (dc), 5.3VA (ac).
 - g. Expected Mechanical Life: 5,000,000 operations.
 - h. Expected Electrical Life at Rated Load: 500,000 operations.
 - i. Manufacturer and Product:
 - 1) Allen-Bradley.
 - 2) Potter and Brumfield; Series KUL.
 - 3) IDEC; Series RR2KP.
5. Control Circuit Switching Relay, Time Delay:
 - a. Type: Adjustable time delay relay.
 - b. Contact Arrangement: 2 Form C contacts.
 - c. Contact Rating: 10A at 30V dc or 277V ac.
 - d. Contact Material: Silver cadmium oxide alloy.
 - e. Coil Voltage: As noted or shown.
 - f. Operating Temperature: Minus 10 degrees C to 55 degrees C.
 - g. Repeatability: Plus or minus 2 percent.
 - h. Delay Time Range: Select range such that time delay set point fall between 20 percent to 80 percent of range.
 - i. Time Delay Set Point: As noted or shown.
 - j. Mode of Operation: As noted or shown.
 - k. Adjustment Type: Integral potentiometer with knob external to dust cover.
 - l. Manufacturer and Products:
 - 1) Weidmuller; 8647700000.
 - 2) Idec.
 - 3) Tyco/Agastat.

O. Power Supplies:

1. Furnish as required to power instruments requiring external dc power, including two-wire transmitters and dc relays. Provide dual power supplies with diode auctioneered outputs.
2. Connect in redundant 2N or N+1 configuration, where N is the number of power supplies required.
3. Convert 120V ac, 60-Hz power to dc power of appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that instruments being supplied can operate within their required tolerances.
4. Provide output over voltage and over current protective devices to:
 - a. Protect instruments from damage due to power supply failure.
 - b. Protect power supply from damage due to external failure.
5. Enclosures: NEMA 1/IP20.
6. UL 508 Listed.
7. Mount such that dissipated heat does not adversely affect other components.
8. Fuses:
 - a. Purpose:
 - 1) For each dc supply line to each individual two-wire transmitter.
 - 2) For each dc branch circuit.
 - b. Type: Indicating.
 - c. Mount so fuses can be easily seen and replaced.
9. Provide same manufacturer for Power Supply and 24V dc UPS systems.
10. Manufacturers:
 - a. Phoenix Contact; Quint SFB with Redundancy Diode Module.
 - b. PULS; Dimension Series with Redundancy Diode Module.
 - c. Sola; SDN-C series with Redundancy Module.
 - d. Or approved equal.

P. Internal Panel Lights for Freestanding Panels:

1. Type: Switched LED lighting package.
2. Quantity: One light for every 4 feet of panel width.
3. Life Expectancy: Minimum 60,000 hours at 68 degrees F.
4. Mounting: Inside and in the top of back-of-panel area.
5. Manufacturer and Product: Hoffman PaneLite series, or equal.

Q. Service Outlets for Freestanding Panels:

1. Type: Three-wire, 120-volt; 15-ampere, ampere, GFCI duplex receptacles. Provide non-GFCI receptacles for panels fed from GFI breakers.

2. Quantity:
 - a. Panels 4 Feet Wide and Smaller: One.
 - b. Panels Larger than 4 Feet Wide: One for every 4 feet of panel width, two minimum per panel.
3. Mounting: DIN Rail mounted evenly spaced along back of panel area.

R. Internal Panel Lights and Service Outlets for Smaller Panels:

1. Internal Panel Light: Switched LED lighting package.
2. Service Outlet: Breaker protected 120-volt, 15-amp, GFCI duplex receptacle. Provide non-GFCI receptacles for panels fed from GFI breakers.
3. Manufacturer and Product: Hoffman PaneLite series, or equal.

S. Standard Pushbutton Colors and Inscriptions: Use following color code and inscriptions for pushbuttons.

| Tag Function | Inscription(s) | Color |
|-------------------|-----------------------|-------------------------|
| OO | ON OFF | Black Black |
| OC | OPEN CLOSE | Black Black |
| OCA | OPEN CLOSE AUTO | Black Black Black |
| OOA | ON OFF AUTO | Black Black Black |
| MA | MANUAL AUTO | Black Black |
| SS | START STOP | Black Black |
| RESET | RESET | Black |
| EMERGENCY STOP | EMERGENCY STOP | Red |

1. Lettering Color:
 - a. Black on white and yellow buttons.
 - b. White on black, red, and green buttons.

- T. Standard Light Colors and Inscriptions: Use following color code and inscriptions for service legends and lens colors for indicating lights.

| Tag Function | Inscription(s) | Color |
|--------------|----------------|--------|
| ON | ON | Green |
| OFF | OFF | Red |
| OPEN | OPEN | Green |
| CLOSED | CLOSED | Red |
| LOW | LOW | Red |
| FAIL | FAIL | Amber |
| HIGH | HIGH | Amber |
| AUTO | AUTO | White |
| MANUAL | MANUAL | Yellow |
| LOCAL | LOCAL | White |
| REMOTE | REMOTE | Yellow |

1. Lettering Color:
 - a. Black on white and amber lenses.
 - b. White on red and green lenses.

2.08 ELECTRICAL TRANSIENT PROTECTION

A. General:

1. Function: Protect elements of PIC against damage due to electrical transients induced in interconnecting lines by lightning and nearby electrical systems.
2. Implementation: Provide, install, coordinate, and inspect grounding of surge suppressors at:
 - a. Connection of ac power to PIC equipment including panels, consoles assemblies, and field mounted analog transmitters and receivers.
 - b. At the field and panel, console, or assembly connection of signal circuits that have portions of the circuit extending outside of a protective building.
3. Construction: First-stage high energy metal oxide varistor and second-stage bipolar silicon avalanche device separated by series impedance. Includes grounding wire, stud, or terminal.
4. Response: 5 nanoseconds maximum.

5. Recovery: Automatic.
 6. Temperature Range: Minus 20 degrees C to plus 85 degrees C.
- B. Suppressors on 120V ac Power Supply Connections:
1. Occurrences: Tested and rated for a minimum of 50 occurrences of IEEE 587 Category B test waveform.
 2. First-Stage Clamping Voltage: 350 volts or less.
 3. Second-Stage Clamping Voltage: 210 volts or less.
 4. Continuous Operation: Power supplies for one four-wire transmitter or receiver: 5 amps minimum at 130V ac. All other applications: 30 amps minimum at 130V ac.
- C. Suppressors on Analog Signal Lines:
1. Test Waveform: Linear 8 microsecond rise in current from 0 amps to a peak current value followed by an exponential decay of current reaching one half the peak value in 20 microseconds.
 2. Surge Rating: Tested and rated for 50 occurrences of 2,000-amp peak test waveform.
 - a. dc Clamping Voltage: 20 to 40 percent above operating voltage for circuit.
 - b. dc Clamping Voltage Tolerance: Less than plus or minus 10 percent.
 - c. Maximum Loop Resistance: 18 ohms per conductor.
- D. Manufacturer and Products:
1. Type 2 (SS2): Analog Signals Lines (Panel Mounted):
 - a. Phoenix Contact; PT 1x2-24DC-ST (2856032).
 - b. Emerson Edco SRA64.
 2. 120V ac Lines:
 - a. Phoenix Contact; PT 2-PE/S-120AC/FM (2856812).
 - b. Emerson Edco HSP-121.
 3. Type 3 (SS3): Field Mounted at Two-Wire Instruments: Encapsulated in stainless steel pipe nipples.
 - a. Phoenix Contact; S-PT-EX-24DC-1/2" (2800035).
 - b. Emerson Edco SS64 series.
 4. Type 4 (SS4): Field Mounted at Four-Wire Instruments: With 120V ac outlet, ac circuit breaker, and 10-ohm resistors on signal lines, all in enclosure.
 - a. Enclosure:
 - 1) NEMA 7 Type 316 stainless steel with door.
 - 2) Maximum Size: 12 inches by 12 inches by 8 inches deep.
 - b. Emerson Edco; SLAC series or Phoenix Contact equal.
 5. Discrete Signal Lines: Phoenix Contact.

- E. Installation and Grounding of Suppressors: As shown. See Surge Suppressor Installation Details. Grounding equipment, installation of grounding equipment, and terminations for field mounted devices are provided under Division 26, Electrical.

2.09 EXPENDABLES

| Item | Quantity |
|-------------------------------------|--|
| Corrosion-inhibiting vapor capsules | Manufacturer's recommended 2-year supply |

2.10 FABRICATION

A. General:

1. Panels with external dimensions and instruments arrangement as shown on Drawings.
2. Panel Construction and Interior Wiring: In accordance with the National Electrical Code, state and local codes, NEMA, ANSI, UL, and ICECA.
3. Fabricate panels, install instruments, wire, and plumb, at the PIC factory.
4. Electrical Work: In accordance with Division 26, Electrical.

- B. Factory Assembly: Assemble panels at the manufacturer's factory. No fabrication other than correction of minor defects or minor transit damage shall be done on panels at Site.

- C. UL Listing Mark for Enclosures: Mark stating "Listed Enclosed Industrial Control Panel" per UL 508A/698A.

D. Wiring Within PIC Panels:

1. Restrain by plastic ties or ducts or metal raceways.
2. Hinge Wiring: Secure at each end so that bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.
3. Arrange wiring neatly, cut to proper length, and remove surplus wire.
4. Abrasion protection for wire bundles which pass through holes or across edges of sheet metal.
5. Connections to Screw Type Terminals:
 - a. Locking-fork-tongue or ring-tongue lugs.
 - b. Use manufacturer's recommended tool with required sized anvil to make crimp lug terminations.
 - c. Wires terminated in a crimp lug, maximum of one.
 - d. Lugs installed on a screw terminal, maximum of two.
6. Connections to Compression Clamp Type Terminals:
 - a. Strip, prepare, and install wires in accordance with terminal manufacturer's recommendations.

- b. Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.
 - 7. Splicing and tapping of wires, allowed only at device terminals or terminal blocks.
 - 8. Terminate 24V dc and analog signal circuits on separate terminal block from ac circuit terminal blocks.
 - 9. Separate analog and dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
 - 10. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.
 - 11. Plastic Wire Ducts Fill: Do not exceed manufacturer's recommendation.
- E. Temperature Control:
- 1. Freestanding Panels:
 - a. Nonventilated Panels: Size to adequately dissipate heat from equipment mounted inside panel or on panel.
 - b. Ventilated Panels: Not acceptable for this project.
- F. Freestanding Panel Construction:
- 1. Materials: Sheet steel, unless otherwise shown on Drawings with minimum thickness of 10-gauge, unless otherwise noted.
 - 2. Panel Fronts:
 - a. Fabricated from a single piece of sheet steel, unless otherwise shown on Drawings.
 - b. No seams or bolt heads visible when viewed from front.
 - c. Panel Cutouts: Smoothly finished with rounded edges.
 - d. Stiffeners: Steel angle or plate stiffeners or both on back of panel face to prevent panel deflection under instrument loading or operation.
 - 3. Internal Framework:
 - a. Structural steel for instrument support and panel bracing.
 - b. Permit panel lifting without racking or distortion.
 - 4. Lifting rings to allow simple, safe rigging and lifting of panel during installation.
 - 5. Adjacent Panels: Securely bolted together so front faces are parallel.
 - 6. Doors: Full height, fully gasketed access doors where shown on Drawings.
 - a. Latches: Three-point, NEMA 4X.
 - b. Handles: "D" ring, foldable type.
 - c. Hinges: Full length, continuous, piano type, steel hinges with stainless steel pins.
 - d. Front Access Doors.

G. Non-freestanding Panel Construction:

1. Based on environmental design requirements required and referenced in Article Environmental Requirements, provide the following:
 - a. For panels listed as inside, air conditioned:
 - 1) Enclosure Type: NEMA 12 in accordance with NEMA 250.
 - 2) Materials: Steel.
 - b. For all other panels:
 - 1) Enclosure Type: NEMA 4X in accordance with NEMA 250.
 - 2) Materials: Type 316 stainless steel.
2. Metal Thickness: 14-gauge, minimum.
3. Doors:
 - a. Rubber-gasketed with continuous hinge.
 - b. Stainless steel lockable quick-release clamps.
4. Manufacturers:
 - a. Hoffman Engineering Co.
 - b. Rittal.

H. Factory Finishing:

1. Enclosures:
 - a. Stainless Steel and Aluminum: Not painted.
 - b. Nonmetallic Panels: Not painted.
 - c. Steel Panels:
 - 1) Sand panel and remove mill scale, rust, grease, and oil.
 - 2) Fill imperfections and sand smooth.
 - 3) Paint panel interior and exterior with one coat of epoxy coating metal primer, two finish coats of two-component type epoxy enamel.
 - 4) Sand surfaces lightly between coats.
 - 5) Dry Film Thickness: 3 mils, minimum.
 - 6) Color: Manufacturer's Standard.
2. Manufacturer's standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment with light gray color.

2.11 CORROSION PROTECTION

A. Corrosion-Inhibiting Vapor Capsule Manufacturers:

1. Northern Instruments; Model Zerust VC.
2. Hoffmann Engineering Co; Model A-HCI.

2.12 SOURCE QUALITY CONTROL

A. General:

1. Engineer may actively participate in many of the tests.
2. Engineer reserves right to test or retest specified functions.
3. Engineer's decision will be final regarding acceptability and completeness of testing.
4. Procedures, Forms, and Checklists:
 - a. Except for Unwitnessed Factory Test, conduct tests in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.
 - b. Describe each test item to be performed.
 - c. Have space after each test item description for sign off by appropriate party after satisfactory completion.
5. Required Test Documentation: Test procedures, forms, and checklists signed by Engineer and Contractor.
6. Conducting Tests:
 - a. Provide special testing materials and equipment.
 - b. Wherever possible, perform tests using actual process variables, equipment, and data.
 - c. If not practical to test with real process variables, equipment, and data provide suitable means of simulation.
 - d. Define simulation techniques in test procedures.
 - e. Test Format: Cause and effect.
 - 1) Person conducting test initiates an input (cause).
 - 2) Specific test requirement is satisfied if correct result (effect), occurs.

B. Unwitnessed Factory Test:

1. Scope: Inspect and test PIC to ensure it is operational, ready for FDT.
2. Location: PIC System Integrator's facility.
3. Integrated Test:
 - a. Interconnect and test PIC, except for primary elements and smaller panels.
 - b. Exercise and test functions.
 - c. Provide stand-alone testing of smaller panels.
 - d. Simulate inputs and outputs for primary elements, final control elements, and panels excluded from test.

C. Factory Demonstration Tests (FDT):

1. Notify Engineer of test schedule 4 weeks prior to start of test.

2. Scope:
 - a. Test entire PIC, with exception of primary elements, final control elements, and certain smaller panels, to demonstrate it is operational.
 - b. Test all PIC supplied panels.
3. Location: PIC System Integrator's facility.
4. Correctness of wiring from panel field terminals to PLC system input/output points and to panel components.
 - a. Simulate each discrete signal at terminal strip.
 - b. Simulate correctness of each analog signal using current source.
5. Operation of communications between PLCs and remote I/O and between PLCs and computers.
6. Operation of communications between the PLC system.
7. Loop-Specific Functions: Demonstrate functions shown on P&IDs, control diagrams, and loop specifications:
 - a. One of each type function; for example, if there are filter backwash sequence control for several identical filters, demonstrate controls for one filter.
 - b. One of each type of function in each panel; for example, but not limited to annunciator operation, controller operation, and recorder operation.
 - c. All required and shown functions for 100 percent of loops.
8. Non-loop-Specific Functions:
 - a. Capacity: Demonstrate that PIC systems have required spare capacity for expansion. Include tests for both storage capacity and processing capacity.
 - b. Timing: Include tests for timing requirements.
 - c. Diagnostics: Demonstrate online and offline diagnostic tests and procedures.
9. Correct deficiencies found and complete prior to shipment to Site.
10. Failed Tests:
 - a. Repeat and witnessed by Engineer.
 - b. With approval of Engineer, certain tests may be conducted by PIC System Integrator and witnessed by Engineer as part of Functional Test.
11. Make following documentation available to Engineer at test site both before and during FDT:
 - a. Drawings, Specifications, Addenda, and Change Orders.
 - b. Master copy of FDT procedures.
 - c. List of equipment to be tested including make, model, and serial number.
 - d. Approved hardware Shop Drawings for equipment being tested.
 - e. Approved preliminary software documentation Submittal.

12. Daily Schedule for FDT:
 - a. Begin each day with meeting to review day's test schedule.
 - b. End each day with each meeting to review day's test results and to review or revise next day's test schedule.

PART 3 EXECUTION

3.01 EXAMINATION

- A. For equipment not provided by PIC, but that directly interfaces with the PIC, verify the following conditions:
 1. Proper installation.
 2. Calibration and adjustment of positioners and I/P transducers.
 3. Correct control action.
 4. Switch settings and dead bands.
 5. Opening and closing speeds and travel stops.
 6. Input and output signals.

3.02 INSTALLATION

- A. Material and Equipment Installation: Retain a copy of manufacturers' instructions at Site, available for review at all times.
- B. Electrical Wiring: As specified in Division 26, Electrical.
- C. Mechanical Systems:
 1. Drawings for PIC Mechanical Systems are diagrammatic and not intended to specifically define element locations or piping and tubing run lengths. Base materials and installations on field measurements.
 2. Copper and Stainless Steel Tubing Support: Continuously supported by an aluminum tubing raceway system.
 3. Plastic Tubing Supports: Except as shown on Drawings, provide continuous support in conduits or by aluminum tubing raceway system.
 4. Install tubing conduit for plastic tubing and tubing raceways parallel with, or at right angles to, structural members of buildings. Make vertical runs straight and plumb.
 5. Tubing and Conduit Bends:
 - a. Tool-formed without flattening, and all of same radius.
 - b. Bend Radius: Equal to or larger than conduit and tubing manufacturer's recommended minimum bend radius.
 - c. Slope instrument connection tubing in accordance with installation details.

- d. Do not run liquid filled instrument tubing immediately over or within a 3-foot plan view clearance of electrical panels, motor starters, or mechanical mounting panel without additional protection. Where tubing must be located in these zones, shield electrical device to prevent water access to electrical equipment.
 - e. Straighten coiled tubing by unrolling on flat surface. Do not pull to straighten.
 - f. Cut tubing square with sharp tubing cutter. Deburr cuts and remove chips. Do not gouge or scratch surface of tubing.
 - g. Blow debris from inside of tubing.
 - h. Make up and install fittings in accordance with manufacturer's recommendations. Verify makeup of tube fittings with manufacturer's inspection gauge.
 - i. Use lubricating compound or TFE tape on stainless steel threads to prevent seizing or galling.
 - j. Run tubing to allow, for example, clear access to doors, controls, and control panels; and to allow for easy removal of equipment.
 - k. Provide separate support for components in tubing runs.
 - l. Supply expansion loops and use adapters at pipe, valve, or component connections for proper orientation of fitting.
 - m. Keep tubing and conduit runs at least 12 inches from hot pipes.
 - n. Locate and install tubing raceways in accordance with manufacturer's recommendations. Locate tubing to prevent spillage, overflow, or dirt from above.
 - o. Securely attach tubing raceways to building structural members.
6. Enclosure Lifting Rings: Remove rings following installation and plug holes.

D. Removal or Relocation of Materials and Equipment:

- 1. Remove from Site materials that were part of the existing facility but are no longer used, unless otherwise directed by Engineer to deliver to Owner.
- 2. Repair affected surfaces to conform to type, quality, and finish of surrounding surface.

3.03 FIELD FINISHING

- A. Refer to Section 09 90 00, Painting and Coating.

3.04 FIELD QUALITY CONTROL

A. Startup and Testing Team:

- 1. Thoroughly inspect installation, termination, and adjustment for components and systems.

2. Complete onsite tests.
 3. Complete onsite training.
 4. Provide startup assistance.
- B. Operational Readiness Inspections and Calibrations: Prior to startup, inspect and test to ensure that entire PIC is ready for operation.
1. Loop/Component Inspections and Calibrations:
 - a. Check PIC for proper installation, calibration, and adjustment on a loop-by-loop and component-by-component basis.
 - b. Prepare component calibration sheet for each active component (except simple hand switches, lights, gauges, and similar items).
 - 1) Project name.
 - 2) Loop number.
 - 3) Component tag number.
 - 4) Component code number.
 - 5) Manufacturer for elements.
 - 6) Model number/serial number.
 - 7) Summary of functional requirements, for example:
 - a) Indicators and recorders, scale and chart ranges.
 - b) Transmitters/converters, input and output ranges.
 - c) Computing elements' function.
 - d) Controllers, action (direct/reverse) and control modes (PID).
 - e) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual).
 - 8) Calibrations, for example:
 - a) Analog Devices: Actual inputs and outputs at 0, 10, 50, and 100 percent of span, rising and falling.
 - b) Discrete Devices: Actual trip points and reset points.
 - c) Controllers: Mode settings (PID).
 - 9) Space for comments.
 - c. These inspections and calibrations will be spot checked by Engineer.
 2. Leak Test: In accordance with Section 40 80 01, Process Piping Leakage Testing.
- C. Performance Acceptance Tests (PAT): These are the activities that Section 01 91 14, Equipment Testing and Facility Startup, refers to as Performance Testing.
1. General:
 - a. Test all PIC elements to demonstrate that PIC satisfies all requirements.

- b. Test Format: Cause and effect.
 - 1) Person conducting test initiates an input (cause).
 - 2) Specific test requirement is satisfied if correct result (effect) occurs.
 - c. Procedures, Forms, and Checklists:
 - 1) Conduct tests in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.
 - 2) Describe each test item to be performed.
 - 3) Have space after each test item description for sign off by appropriate party after satisfactory completion.
 - d. Required Test Documentation: Test procedures, forms, and checklists. All signed by Engineer and Contractor.
 - e. Conducting Tests:
 - 1) Provide special testing materials, equipment, and software.
 - 2) Wherever possible, perform tests using actual process variables, equipment, and data.
 - 3) If it is not practical to test with real process variables, equipment, and data, provide suitable means of simulation.
 - 4) Define simulation techniques in test procedures.
 - f. Coordinate PIC testing with Owner and affected Subcontractors.
Excessive Test Witnessing: Refer to Supplementary Conditions.
2. Test Requirements:
- a. Once facility has been started up and is operating, perform a witnessed PAT on complete PIC to demonstrate that it is operating as required. Demonstrate each required function on a paragraph-by-paragraph and loop-by-loop basis.
 - b. Perform local and manual tests for each loop before proceeding to remote and automatic modes.
 - c. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible.
 - d. Make updated versions of documentation required for PAT available to Engineer at Site, both before and during tests.
 - e. Make one copy of O&M manuals available to Engineer at the Site both before and during testing.
 - f. Refer to referenced examples of PAT procedures and forms in Article Supplements.

3.05 TRAINING

A. General:

1. Provide an integrated training program to meet specific needs of Owner's personnel.
2. Include training sessions, classroom and field, for managers, engineers, operators, and maintenance personnel.
3. Provide instruction on two working shift(s) as needed to accommodate the Owner's personnel schedule.
4. Owner reserves the right to make and reuse video tapes of training sessions.

B. Operations and Maintenance Training:

1. Include a review of O&M manuals and survey of spares, expendables, and test equipment.
2. Use equipment similar to that provided or currently owned by Owner.
3. Provide training suitable for instrument technicians with at least a 2-year associate engineering or technical degree, or equivalent education and experience in electronics or instrumentation.

C. Operations Training:

1. Training Session Duration: One 8-hour instructor days.
2. Number of Training Sessions: Two.
3. Location: Site.
4. Content: Conduct training on loop-by-loop basis.
 - a. Loop Functions: Understanding of loop functions, including interlocks for each loop.
 - b. Loop Operation: For example, adjusting process variable setpoints, AUTO/MANUAL control transfer, AUTO and MANUAL control, annunciator acknowledgement and resetting.
 - c. Interfaces with other control systems.

D. Maintenance Training:

1. Training Session Duration: One 8-hour instructor days.
2. Number of Training Sessions: Two.
3. Location: Project Site.
4. Content: Provide training for each type of component and function provided.
 - a. Loop Functions: Understanding details of each loop and how they function.
 - b. Component calibration.

- c. Adjustments: For example, controller tuning constants, current switch trip points, and similar items.
- d. Troubleshooting and diagnosis for components.
- e. Replacing lamps, chart paper, fuses.
- f. Component removal and replacement.
- g. Periodic maintenance.

3.06 CLEANING/ADJUSTING

- A. Repair affected surfaces to conform to type, quality, and finish of surrounding surface.
- B. Cleaning:
 - 1. Prior to closing system using tubing, clear tubing of interior moisture and debris.
 - 2. Upon completion of Work, remove materials, scraps, and debris from interior and exterior of equipment.

3.07 PROTECTION

- A. Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.
- B. Periodically replace capsules in accordance with capsule manufacturer's recommendations. Replace capsules just prior to Final Payment and Acceptance.

3.08 SUPPLEMENTS

- A. Supplements listed below, following "End of Section," are part of this Specification.
 - 1. Instrument Calibration Sheet: Provides detailed information on each instrument (except simple hand switches, lights, and similar items).
 - 2. Performance Acceptance Test Sheet: Describes the PAT for a given loop. The format is mostly free form.
 - a. Lists the requirements of the loop.
 - b. Briefly describes the test.
 - c. Cites expected results.
 - d. Provides space for check off by witness.

END OF SECTION

CH2M HILL

INSTRUMENT CALIBRATION SHEET

Rev.06.05.92

| | | | | | | | | | | | |
|-----------------------------|---------------|--------|---------------------|----------------------------|------------------|------------------------------|---|--------------------------|---------------|--------------------------|---------------------|
| COMPONENT | | | MANUFACTURER | | | | PROJECT | | | | |
| Code: | | | Name: | | | | Number: | | | | |
| Name: | | | Model: | | | | Name: | | | | |
| | | | Serial #: | | | | | | | | |
| FUNCTIONS | | | | | | | | | | | |
| Indicate? Y / N | RANGE | VALUE | UNITS | COMPUTING FUNCTIONS? Y / N | | | CONTROL? Y / N | | | | |
| Record? Y / N | Chart: | | | Describe: | | | Action? direct / reverse | | | | |
| Transmit/ Convert? Y / N | Scale: | | | | | | Modes? P / I / D | | | | |
| Input: | Switch? | | | | | | SWITCH? Y / N | | | | |
| | Unit Range: | | | | | | Unit Range: | | | | |
| Output: | Differential: | | | | | | Differential: fixed/adjustable | | | | |
| | Reset? | | | | | | Reset? automatic / manual | | | | |
| ANALOG CALIBRATIONS | | | | | | DISCRETE CALIBRATIONS | | | | | Note No. |
| REQUIRED | | | AS CALIBRATED | | | REQUIRED | | | AS CALIBRATED | | |
| Input | Indicated | Output | Increasing Input | | Decreasing Input | | Number | Trip Point | Reset Pt. | Trip Point | Reset Pt. |
| | | | Indicated | Output | Indicated | Output | | (note rising or falling) | | (note rising or falling) | |
| | | | | | | | 1. | | | | |
| | | | | | | | 2. | | | | |
| | | | | | | | 3. | | | | |
| | | | | | | | 4. | | | | |
| | | | | | | | 5. | | | | |
| | | | | | | | 6. | | | | |
| | | | | | | | 7. | | | | |
| CONTROL MODE SETTINGS: | | | P: | I: | D: | | | | | | |
| # | NOTES: | | | | | | Component Calibrated and Ready for Startup By: Date: Tag No.: | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

CH2M HILL

INSTRUMENT CALIBRATION SHEET
EXAMPLE - ANALYZER/TRANSMITTER

Rev.06.05.92

| COMPONENT | | | MANUFACTURER | | | | PROJECT | | | | | |
|---|--|--------|------------------------|------------------------|------------------|--------|---|--------------------------|-----------|---|-----------|----|
| Code: A7 | | | Name: Leeds & Northrup | | | | Number: WDC30715.B2 | | | | | |
| Name: pH Element & Analyzer/Transmitter | | | Model: 12429-3-2-1-7 | | | | Name: UOSA AWT PHASE 3 | | | | | |
| | | | Serial #: 11553322 | | | | | | | | | |
| FUNCTIONS | | | | | | | | | | | | |
| | RANGE | VALUE | UNITS | COMPUTING FUNCTIONS? N | | | CONTROL? N | | | | | |
| Indicate? Y Record? N | Chart: | | | Describe: | | | Action? direct / reverse Modes? P / I / D | | | | | |
| | Scale: | 1-14 | pH units | | | | SWITCH? N Unit Range: Differential: fixed/adjustable Reset? automatic / manual | | | | | |
| Transmit/ Convert? Y | Input: | 1-14 | pH units | | | | | | | | | |
| | Output: | 4-20 | mA dc | | | | | | | | | |
| ANALOG CALIBRATIONS | | | | | | | DISCRETE CALIBRATIONS | | | | Note | |
| REQUIRED | | | AS CALIBRATED | | | | REQUIRED | | | AS CALIBRATED | | No |
| Input | Indicated | Output | Increasing Input | | Decreasing Input | | Number | Trip Point | Reset Pt. | Trip Point | Reset Pt. | |
| | | | Indicated | Output | Indicated | Output | | (note rising or falling) | | (note rising or falling) | | |
| 1.0 | 1.0 | 4.0 | 1.0 | 4.0 | 1.0 | 3.9 | 1. | N.A. | | N.A. | | |
| 2.3 | 2.3 | 5.6 | 2.2 | 5.5 | 2.3 | 5.6 | 2. | | | | | |
| 7.5 | 7.5 | 12.0 | 7.5 | 11.9 | 7.5 | 12.0 | 3. | | | | | |
| 12.7 | 12.7 | 18.4 | 12.7 | 18.3 | 12.6 | 18.3 | 4. | | | | | |
| 14.0 | 14.0 | 20.0 | 14.0 | 20.0 | 14.0 | 20.0 | 5. | | | | | |
| | | | | | | | 6. | | | | | |
| | | | | | | | 7. | | | | | |
| CONTROL MODE SETTINGS: | | | P: N.A. | I: | D: | | | | | | | |
| # | NOTES: | | | | | | | | | Component Calibrated and Ready for Startup | | |
| | 1. Need to recheck low pH calibration solutions. | | | | | | | | | By: J.D. Sewell | | |
| | | | | | | | | | | Date: Jun-6-92 | | |
| | | | | | | | | | | Tag No.: AIT-12-6[pH] | | |

CH2M HILL PERFORMANCE ACCEPTANCE TEST SHEET
EXAMPLE

Rev.06.05.92

| | | | |
|---|-----------------------------|---------------------------------|---|
| Project Name: <i>SFO SEWPCP Plant Expansion</i> | | Project No.: <i>SFO12345.C1</i> | |
| Demonstration Test(s): For each functional requirement of the loop: (a) List and number the requirement. (b) Briefly describe the demonstration test. (c) Cite the results that will verify the required performance. (d) Provide space for signoff. | | | |
| <i>1. MEASURE EFFLUENT FLOW</i> | | | |
| <i>1.a With no flow, water level over weir should be zero and</i> | | | |
| <i>FIT indicator should read zero.</i> | | <i>Jun-20-92 BDG</i> | |
| <i>2. FLOW INDICATION AND TRANSMISSION TO LP & CCS</i> | | | |
| <i>With flow, water level and FIT indicator should be related by expression</i> | | | |
| <i>$Q(\text{MGD}) = 429 * H^{2/3}$ (H = height in inches of water over weir).</i> | | | |
| <i>Vary H and observe that following.</i> | | | |
| <i>2.a Reading of FIT indicator.</i> | | <i>Jun-6-92 BDG</i> | |
| <i>2.b Reading is transmitted to FI on LP-521-1.</i> | | <i>Jun-6-92 BDG</i> | |
| <i>2.c Reading is transmitted and displayed to CCS.</i> | | <i>Jun-6-92 BDG</i> | |
| <i>H(measured)</i> | <i>0</i> | <i>5</i> | <i>10 15</i> |
| <i>Q(computed)</i> | <i>0</i> | <i>47.96</i> | <i>135.7 251.7</i> |
| <i>Q(FIT indicator)</i> | <i>0</i> | <i>48.1</i> | <i>137 253</i> |
| <i>Q(LI on LP-521-1)</i> | <i>0</i> | <i>48.2</i> | <i>138 254</i> |
| <i>Q(display by CCS)</i> | <i>0</i> | <i>48.1</i> | <i>136.2 252.4</i> |
| Forms/Sheets Verified | | | |
| Loop Status Report | By <i>J.D. Sewell</i> | Date <i>May-18-92</i> | Loop Accepted By Owner By: <i>J.D. Smith</i> Date: <i>Jun-6-92</i> |
| Instrument Calibration Sheet | By <i>J.D. Sewell</i> | Date <i>May-18-92</i> | |
| I&C Valve Calibration Sheet | By <i>N.A.</i> | Date | |
| Performance Acceptance Test | | | |
| Performed | By <i>J. Blow MPSDC Co.</i> | Date <i>Jun-6-92</i> | Loop No.: <i>30-12</i> |
| Witnessed | By <i>B.deGlanville</i> | Date <i>Jun-6-92</i> | |