CITY OF ALAMEDA
ALAMEDA COUNTY, CALIFORNIA

TECHNICAL PROVISIONS
FOR THE
CONSTRUCTION OF

CITY OF ALAMEDA
STORM DRAIN PUMP STATION ELECTRICAL UPGRADES

PROJECT NO. P.W. 09-19-48

MAY 21, 2021

SECTION 01005
CERTIFICATION

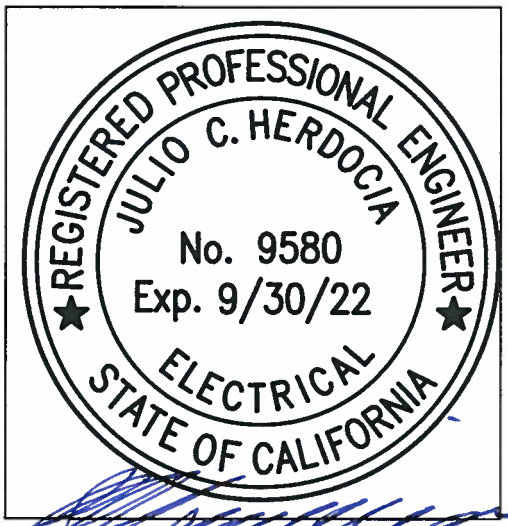
THE FOLLOWING SECTIONS:

Division 16

OF THESE TECHNICAL PROVISIONS WERE PREPARED UNDER THE SUPERVISION OF:

Julio C. Herdocia, P.E.
California Registered Electrical Engineer No. E9580
Expiration 9/30/22

MTH Engineers, Inc.
3350 Scott Boulevard # 11
Santa Clara, CA 95054
(408) 986-8558



05-24-21

THE FOLLOWING SECTIONS:

Divisions 1, 2, 3, 5, 8, 11 and 15.

OF THESE TECHNICAL PROVISIONS WERE PREPARED UNDER THE SUPERVISION OF:

Benjamin L. Shick, P.E.
California Registered Civil Engineer No. 68813
Expiration 9/30/21

Schaaf & Wheeler, Consulting Civil Engineers
1171 Homestead Rd, Suite 255
Santa Clara, CA 95050
(408) 246-4848

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2 - SITE CONSTRUCTION

DIVISION 3 - CONCRETE

DIVISION 5 - METALS

DIVISION 8 - OPENINGS

DIVISION 11 - EQUIPMENT

DIVISION 15 – MECHANICAL SYSTEMS

DIVISION 16 - ELECTRICAL

END OF SECTION

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SECTION 01110
SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Identification and summary description of the Project, the Work, location, City furnished products, activities by others and coordination.

1.02 THE PROJECT

A. The project consists of removing and replacing the existing electrical equipment at four (4) storm drain pump stations. The work includes replacing the wetwell, pumps, piping, valves, and appurtenances at one of the four pump stations. Equipment to be replaced and installed includes control panels, service pedestals, SCADA poles, concrete pads, stairs, fences, gates, electrical equipment, and other items shown to be constructed on the contract drawings or specifications, including repair, and reconstruction of existing improvements affected by the Work, and incidentals for complete and usable facility.

B. The work to be done under this Contract includes the furnishing of all project management, labor, materials, tools, equipment and services necessary for and incidental to the construction of the Project as noted on the Plans and in the Specifications and all other Contract Documents including the General Conditions and General Requirements.

1.03 LOCATION OF PROJECT

A. The Work is located at various locations in Alameda, California.

1.04 CITY FURNISHED EQUIPMENT

A. City will not furnish any specific equipment.

1.05 ACTIVITIES BY OTHERS

A. City, utilities, and others may perform activities within Project area while the Work is in progress.

1. Schedule the Work with City, utilities, and others to minimize mutual interference.

1.06 COORDINATION OF WORK

A. Maintain overall coordination of the Work.

B. Obtain construction schedules from each subcontractor, and require each subcontractor to maintain schedules and coordinate modifications.

1.07 PROJECT IDENTIFICATION

A. General:

1. The Project Name is “Storm Drain Pump Station Electrical Upgrades, PW 09-19-48.”

2. Contract Documents have been prepared by the City of Alameda Public Works Department.

3. The extent of Contracted Work is indicated on the Plans and Specifications.

1.08 SUMMARY OF REFERENCES

A. Contracted Work can be summarized by references to the Proposal and Contract Requirements, General Conditions, Special Provisions, sections in the Technical Specifications, Plans, Addenda, Notice to Bidders and Modifications to the Contract Documents.

B. It is recognized that the Contracted Work may also be unavoidably affected or influenced by other governing codes and regulations, natural phenomenon, including weather conditions and other forces outside the Contract Documents.

1.09 PLANS AND SPECIFICATIONS

A. As shown on the Plans and/or described in the Specifications, each element of the Work must be furnished complete, finished and functional. Whether shown or not, include all materials and ancillary equipment necessary to provide a complete installation. The Plans, Specifications, and other Contract Documents are intended to be complementary and cooperative to describe and provide for a complete project. Anything in the Specifications and not on the Plans, or on the Plans and not in the Specifications, shall be as though shown or mentioned in both. Details shown for an item of Work are typical and shall apply to similar items of Work.

B. Do not deviate from the Plans and Specifications without written authorization from the Engineer.

C. The Engineer does not warrant the accuracy of scaled dimensions. Dimensions indicated by figures or numerals shall govern. Larger scale drawings shall take precedence over smaller scale drawings.

D. References made to other specifications and codes refer to the edition including amendments in effect and published at the time of advertising the project, unless specifically referred to by edition, volume, or date as noted in the Contract Documents.

1.10 PRECEDENCE OF CONTRACT DOCUMENTS

A. Supplemental Agreements, Change Orders, Engineer's written interpretations and clarifications, and Addenda, will take precedence over all other components of the Contract Documents. Shown dimensions take precedence over scaled dimensions. Detailed drawings will take precedence over general drawings.

1.11 GROUND BREAKING CEREMONY

A. Not required.

1.12 OCCUPANCY OF PORTIONS OF WORK

A. Through City contacts, Contractor shall coordinate work with the neighboring property owners to minimize disruption to their operations.

B. Certificates of Substantial Completion will be executed for each designated portion of Work prior to City occupancy including specified testing, training of City's personnel, and other preparations necessary for City's occupancy or use of the facility.

C. Certificates of Substantial Completion will be executed for each designated portion of Work completed prior to City occupancy.

1. Such certificate of Substantial Completion will describe the portion of the Work to be occupied by City, items that may be incomplete or defective, date of occupancy by City, and other information required by City and Contractor.

D. After City occupancy, allow access for City's personnel, access for others authorized by City, and City operation of equipment and systems.

E. Following Occupancy, City will:

1. Provide power to operate equipment and systems.

2. Repair damage caused by City's occupancy.

F. Prior to such occupancy or use, enter into agreement with City indicating work that remains to be performed in occupied areas.

G. When City's use of occupied facilities reveal defective work, correct defects.

H. No partial acceptance of the Work will be made and no acceptance other than the final acceptance of the completed Work will be made except for those portions of Work designated for early occupancy by City.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01125
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 MEASUREMENT OF QUANTITIES

A. Measurements of the completed work shall be in accordance with, and by instruments and devices calibrated to United States Standard Measures and the units of measurement for payment, and the limits thereof, shall be made as shown on the Plans, Specifications, General Requirements, and Supplementary Conditions.

B. Payment for the various items of the Bid Schedule, as further described herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies and manufactured items and for all operations, and incidental appurtenances to the items of work being described, as necessary to complete the various items of work all in accordance with the requirements of the Contract Documents. Payment for the various items of the Bid Schedule shall include all costs of permits, business licenses, and the cost of compliance with the regulations of public agencies having jurisdiction, including the Department of Public Health, Safety and Health Requirements of the California Division of Industrial Safety and the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). The City of Alameda Building Permit has been applied for and paid for, the Contractor is responsible for obtaining the permit and adhering to all requirements. No separate payment will be made for any item that is not specifically set forth in the Bid Schedule, and all costs therefore shall be included in the prices named in the Bid Schedule for various appurtenant items of work.

1.02 UNITS OF MEASUREMENT

A. Measurements shall be in accordance with U.S. Standard Measures. A pound is an avoirdupois pound. A ton is 2,000 pounds avoirdupois. The unit of liquid measure is the U.S. gallon.

B. When payment is to be made on the basis of weight, the weighing shall be done on certified platform scales, or when approved by the City’s Representative, on a completely automated weighing and recording system. The Contractor shall furnish the City’s Representative with duplicate licensed weighmaster's certificates showing the actual net weights. The City will accept the certificates as evidence of the weights delivered.

1.03 METHODS OF MEASUREMENT

A. Materials and items of work, which are to be paid for on the basis of measurement, shall be measured in accordance with the method stipulated in the particular sections involved. In determining quantities, all measurements shall be made in a horizontal plane unless otherwise specified.

B. Material not used in the work and remaining on a transporting vehicle shall be determined by the City's Representative and deducted from the certified tag.

C. When material is to be measured and paid for on a volume basis and it would be impractical to determine the volume, or when requested by the Contractor in writing and approved by the City in writing, the material will be weighed and converted to volume measurement for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the City and shall be agreed to by the Contractor before such method of measurement of pay quantities will be adopted.

D. Full compensation for all expense involved in conforming to the above requirements for measuring and weighing materials shall be considered as included in the unit prices paid for the materials being measured or weighed and no additional allowances will be made therefore.

E. Quantities of material wasted or disposed of in a manner not called for under the Contract; or rejected loads of material, including material rejected after it has been placed by reason of failure of the Contractor to conform to the provisions of the Contract; or material not unloaded from the transporting vehicle; or material placed outside the lines indicated on the plans or given by the City's Representative; or material remaining on hand after completion of the Contract, will not be paid for and such quantities will be deducted from the final total quantities. No compensation will be allowed for hauling rejected material.

1.04 DESCRIPTION OF BID ITEMS

A. The bid items are presented to indicate major categories of the work for purposes of comparative bid analyses, and a preliminary breakdown for monthly progress payments. Bid items are not intended to be exclusive descriptions of work categories and the Contractor shall determine and include in its pricing all materials, labor, and equipment necessary to complete each Bid Item as shown and specified.

B. Contractor shall perform all work depicted in the Contract Documents whether it is specifically mentioned in the Bid Schedule and bid item descriptions or not. The Bid Schedule and the Bid Item Descriptions below are intended to cover any and all Work depicted in the Contract Documents. Not all elements of every part of the Work are explicitly listed. It is the intention of City and a provision of this Contract, that any and all of the Work depicted shall be included in Contractor's bid and installed complete at a price included in a Bid Item submitted with Contractor's bid. No adjustments will be made to unit, extended, or total prices for an item that is depicted in the contract documents but is not specifically described or itemized. Such items may be included for payment in a bid item of the Contractors' choice, as long as the chosen bid item is closely related.

C. Each bid item shall include all work necessary to prepare, implement, and maintain a traffic control plan for that portion of work. Each bid item shall also include all work to prepare and implement a Storm Water Pollution Control Plan

(WPCP) and the requisite construction Best Management Practices (BMPs) to prevent the illegal discharge of pollutants to San Francisco Bay.

D. Bid Item Descriptions

1. Mobilization and Demobilization

The lump sum bid price for this item shall constitute full compensation for preparatory work and operations, including but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project sites; for the establishment of all temporary fencing and other facilities necessary for work on the Project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items.

This bid item also includes demobilization at the completion of work. The City will reserve ten percent of this bid item for payment upon the completion of the work and full demobilization from the site.

2. Third Street Demolition and Abandonment

The lump sum price bid for this item shall constitute full compensation for all work, equipment, and materials necessary for abandoning, demolishing, removing, and disposing of equipment and materials at the Third Street Pump Station. Items include but are not limited to; removing the existing wetwell, pump, piping, SCADA pole, chain link fence, gate, control panel, asphalt pavement, concrete curb, and all other items as identified in the Contract Documents.

3. Third Street Shoring of Open Excavations

The lump sum bid price for this item shall constitute full compensation for the cost of furnishing, installing, maintaining, protecting, and removing shoring for the protection of life and limb in trenches and open excavations at the Third Street Pump Station, which shall conform to applicable safety orders.

4. Third Street Lower Manhole

The lump sum price bid for this item shall constitute full compensation for all work, equipment, and materials necessary for lowering the existing manhole at the Third Street Pump Station. Items include but are not limited to; removal and replacement of the asphalt pavement, removing and reinstalling the existing frame and casting, removing the risers, saw cutting the existing manhole, installing new riser rings, and all other items as identified in the Contract Documents.

5. Third Street Submersible Pumps, Rails & Accessories

This bid item includes all work, materials, and equipment required to furnish and install rail-mounted submersible sewage pumps, pump discharge elbows, lifting chains, guide rails and mounts, power cables and other items necessary to provide a functioning pump installation. Payment for this bid item shall be on a per pump basis.

6. Third Street Discharge Piping and Valves

This bid item includes all material, labor, and equipment required to furnish and install all elbows, pipe spools, fittings, valves, couplings, and accessories necessary to provide a complete and functional pump discharge in conformance with the requirements of these Specifications and the Contract Drawings. This bid item includes all necessary clearing, grubbing, excavation, bedding, backfill, pipe penetrations, wetwell connections, piping system testing, and other items necessary for the construction of the discharge piping system. Payment for this bid item shall be on a lump sum basis.

7. Third Street 8' Diameter Wetwell

   This bid item includes all necessary materials, equipment, and labor necessary to furnish and install a precast concrete wetwell, top slab, access hatch, chamfers, and accessories as indicated on the Contract drawings. This bid item includes excavation, dewatering, subgrade preparation, backfill, compaction, and other items as necessary to construct the new wetwell. This bid item includes testing the wetwell. Payment for this item shall be paid on a lump sum basis.

8. Third Street SCADA Pole

   The lump sum bid price for this bid item shall constitute full compensation for all material, labor, equipment, tools, and services necessary to furnish and properly install SCADA pole and antenna, pole foundation, grounding, conductors, conduits and fittings at the Third Street Pump Station as required in the Contract Documents.

9. Third Street Electrical Control Panel and Concrete Pad

   This bid item includes all labor, materials, and equipment necessary to furnish and install a fully functional electrical control panel at the Third Street Pump Station conforming to the requirements of the Contract Documents. Also included in this pay item is the installation of a reinforced concrete equipment pad, anchorage, anchorage design, and all necessary appurtenances required to install a new control panel and reinforced concrete equipment pad. Payment for this bid item shall be on a lump sum basis.

10. Third Street Service Pedestal and Concrete Pad

    This bid item includes all labor, materials, and equipment necessary to furnish and install a fully functional electrical service and pedestal at the Third Street Pump Station conforming to the requirements of the Contract Documents. This bid item includes all labor, materials, and equipment necessary to coordinate with the electrical utility and construct the improvements from the point of service connection to the service pedestal. This bid item also includes all necessary excavation, bedding, backfill, surface restoration, installation of a reinforced concrete equipment pad, anchorage, anchorage design, all necessary appurtenances required to install a new service pedestal and reinforced concrete equipment pad, and sidewalk replacement as necessary to construct the electrical service and pedestal. Payment for this bid item shall be on a lump sum basis.

11. Third Street Picket Fence & Gates

    This bid item includes all labor, materials, and equipment necessary to furnish and install picket fencing and gates at the Third Street Pump Station conforming to the requirements of the Contract Documents. Payment for this bid item shall be on a lump sum basis.

12. Third Street Site Paving and Curb

    The lump sum bid price for this item constitutes full payment for all materials, equipment, and labor necessary for the installation of new AC pavement and concrete curb at the Third Street Pump Station. This bid item includes all other items as indicated on the Contract Documents and as necessary for construction of the improvements.

13. Third Street Site Restoration and Cleanup

    The lump sum bid price for this item constitutes full payment for all materials, equipment, and labor necessary for the reconstruction of curbs, gutters, sidewalks, irrigation, landscaping, and other improvements damaged or modified during construction and to leave the project site in a clean and fully usable condition upon job acceptance by the City. This bid item includes moving existing boulders surrounding the pump station as necessary to conform to the proposed conditions. This bid item includes all other items as indicated on the Contract Documents and as necessary for construction of the improvements.

14. Third Street Miscellaneous Electrical Work, Wiring, and Sensors

    This bid item includes all materials, equipment, and labor necessary to modify and replace existing electrical wiring and sensors as required to provide a fully functioning electrical system conforming to the Contract Documents. Work includes, but is not limited to, supply and installation of conduits and conductors; supply, installation and calibration of sensors and electrical devices; wiring, mounting of level sensors; pull boxes; and any additional work required to provide a fully functional system. This bid item also includes all necessary excavation, bedding, backfill, AC pavement replacement, and other items as necessary to construct the improvements. Payment for this bid item shall be on a lump sum basis.

15. Third Street Bollard

    This bid item includes all necessary labor, materials, and equipment to furnish and install removable bollards conforming to the requirements of the Contract Documents. This bid item includes all necessary clearing, grubbing, excavation, bedding, backfill, concrete, paint, and other items necessary. Payment for this bid item shall be on a per bollard basis.

16. Golf Course Demolition and Abandonment

    The lump sum price bid for this item shall constitute full compensation for all work, equipment, and materials necessary for abandoning, demolishing, removing, and disposing of equipment and materials at the Golf Course Pump Station. Items include but are not limited to; remove the existing electrical wiring, the control panel, associated appurtenances, and all other items as identified in the Contract Documents.

17. Golf Course Electrical Control Panel

    This bid item includes all labor, materials, and equipment necessary to furnish and install a fully functional electrical control panel at the Golf Course Pump Station conforming to the requirements of the Contract Documents. This bid item also includes anchorage, anchorage design, all necessary appurtenances required to install the control panel on the new concrete vault. Payment for this bid item shall be on a lump sum basis.

18. Golf Course Service Pedestal

    This bid item includes all labor, materials, and equipment necessary to furnish and install a fully functional electrical service and pedestal for the Golf Course Pump Station conforming to the requirements of the Contract Documents. This bid item includes all labor, materials, and equipment necessary to coordinate with the electrical utility and construct the improvements from the point of service connection to the service pedestal. This bid item also includes all necessary excavation, bedding, backfill, surface restoration, all necessary appurtenances required to install a new service pedestal as necessary to construct the electrical service pedestal. Payment for this bid item shall be on a lump sum basis.

19. Golf Course Generator Receptacle

    The lump sum price for this bid item shall constitute full compensation for all material, labor, equipment, tools, and services necessary to furnish and properly install generator receptacle, grounding, conductors, conduits and fittings at the Golf Course Pump Station as required in the Contract Documents.

20. Golf Course SCADA/Light Pole

    The lump sum bid price for this bid item shall constitute full compensation for all material, labor, equipment, tools, and services necessary to furnish and properly install a combination SCADA and light pole, antenna, pole foundation, grounding, conductors, conduits and fittings at the Golf Course Pump Station as required in the Contract Documents.

21. Golf Course Light Pole

    The lump sum bid price for this bid item shall constitute full compensation for all material, labor, equipment, tools, and services necessary to furnish and properly install light pole, pole foundation, grounding, conductors, conduits and fittings at the Golf Course Pump Station as required in the Contract Documents.

22. Golf Course Precast Vault

    This bid item includes all labor, materials, tools, equipment, and incidentals to furnish and install a precast concrete vault with lid onto which the electrical equipment will be installed conforming to the requirements of the Contract Documents. Filling of vault with gravel, safety railings, and access stairs are included under this bid item. This bid item also includes excavation, subgrade preparation, backfill, compaction, concrete pad for stair landing, and surface restoration as necessary to construct the precast concrete vault. Payment for this bid item will be on a lump sum basis.

23. Golf Course Concrete Access Pad

    This bid item includes all necessary labor, materials, and equipment to furnish and install cast-in-place concrete access pad for a portable generator conforming to the requirements of the Contract Documents. This bid item includes all necessary clearing, grubbing, excavation, bedding, backfill, compaction, and other items necessary for construction of cast-in-place concrete access pad. Payment for this bid item shall be on a lump sum basis.

24. Golf Course Bollard

    This bid item includes all necessary labor, materials, and equipment to furnish and install removable bollards conforming to the requirements of the Contract Documents. This bid item includes all necessary clearing, grubbing, excavation, bedding, backfill, concrete, paint, and other items necessary. Payment for this bid item shall be on a per bollard basis.

25. Golf Course Site Restoration and Cleanup

    The lump sum bid price for this item constitutes full payment for all materials, equipment, and labor necessary for the reconstruction of curbs, gutters, sidewalks, irrigation, landscaping, and other improvements damaged or modified during construction and to leave the project site in a clean and fully usable condition upon job acceptance by the City. This bid item includes all other items as indicated on the Contract Documents and as necessary for construction of the improvements.

26. Golf Course Miscellaneous Electrical Work, Wiring, and Sensors

    This bid item includes all materials, equipment, and labor necessary to modify and replace existing electrical wiring and sensors as required to provide a fully functioning electrical system conforming to the Contract Documents. Work includes, but is not limited to, supply and installation of conduits and conductors; supply, installation and calibration of sensors and electrical devices; wiring, electrical and telephone pull boxes; and any additional work required to provide a fully functional system. This bid item also includes all necessary excavation, bedding, backfill, AC pavement replacement, and other items as necessary to construct the improvements. Payment for this bid item shall be on a lump sum basis.

27. Main Street Demolition and Abandonment

    The lump sum price bid for this item shall constitute full compensation for all work, equipment, and materials necessary for abandoning, demolishing, removing, and disposing of equipment and materials at the Main Street Pump Station. Items include but are not limited to; removing the existing control panel, SCADA pole and associated equipment, concrete pad and all other items as identified in the Contract Documents.

28. Main Street Electrical Control Panel

    This bid item includes all labor, materials, and equipment necessary to furnish and install a fully functional electrical control panel at the Main Street Pump Station conforming to the requirements of the Contract Documents. This bid item also includes anchorage, anchorage design, all

necessary appurtenances required to install the new control panel on the new concrete pad. Payment for this bid item shall be on a lump sum basis.

29. Main Street Relocate Trash Rake Control Panel

    This bid item includes all labor, materials, and equipment necessary to remove the existing trash rake control panel and reinstall the control panel on the new concrete access pad at the Main Street Pump Station conforming to the requirements of the Contract Documents. This bid item includes anchoring the panel to the concrete pad. Payment for this bid item shall be on a lump sum basis.

30. Main Street SCADA Pole

    The lump sum bid price for this bid item shall constitute full compensation for all material, labor, equipment, tools, and services necessary to furnish and properly install SCADA pole and antenna, pole foundation, grounding, conductors, conduits and fittings at the Main Street Pump Station as required in the Contract Documents.

31. Main Street Generator Receptacle

    The lump sum price for this bid item shall constitute full compensation for all material, labor, equipment, tools, and services necessary to furnish and properly install generator receptacle, grounding, conductors, conduits and fittings at the Main Street Pump Station as required in the Contract Documents.

32. Main Street Raise Concrete Pad

    This bid item includes all labor, materials, and equipment necessary to raise the existing concrete pad as shown on the Contract Documents. Work includes but is not limited to topographic surveying to determine the existing pad elevation, constructing a new concrete pad, and all other items necessary to raise the concrete pad. Payment for this bid item shall be on a lump sum basis.

33. Main Street Staircase and Handrail

    This bid item includes all labor, materials, tools, equipment, and incidentals to furnish and install staircase and handrail. This bid item also includes excavation, dewatering, subgrade preparation, backfill, compaction, concrete pad for stair landing, hardware required to secure staircase and handrail to raised concrete pad, and surface restoration as necessary to install staircase. Payment for this bid item will be on a lump sum basis

34. Main Street Site Restoration and Cleanup

    The lump sum bid price for this item constitutes full payment for all materials, equipment, and labor necessary for the reconstruction of curbs, gutters, sidewalks, irrigation, landscaping, and other improvements damaged or modified during construction and to leave the project site in a clean and fully usable condition upon job acceptance by the City. This bid item includes all other items as indicated on the Contract Documents and as necessary for construction of the improvements.

35. Main Street Miscellaneous Electrical Work, Wiring, and Sensors

    This bid item includes all materials, equipment, and labor necessary to modify and replace existing electrical wiring and sensors as required to provide a fully functioning electrical system conforming to the Contract Documents. Work includes, but is not limited to, supply and installation of conduits and conductors; supply, installation and calibration of sensors and electrical devices; wiring, trash rake and pump junction boxes, and in-ground pullboxes; and any additional work required to provide a fully functional system. This bid item also includes all necessary excavation, bedding, backfill, AC pavement replacement, and other items as necessary to construct the improvements. Payment for this bid item shall be on a lump sum basis.

36. Webster Street Demolition and Abandonment

    The lump sum price bid for this item shall constitute full compensation for all work, equipment, and materials necessary for abandoning, demolishing, removing, and disposing of equipment and materials at the Webster Street Pump Station. Items include but are not limited to; removing the existing control panel, SCADA pole and equipment, electrical and lighting equipment, service pedestal and meter, sidewalk, and all other items as identified in the Contract Documents.

37. Webster Street Electrical Control Panel

    This bid item includes all labor, materials, and equipment necessary to furnish and install a fully functional electrical control panel at the Webster Street Pump Station conforming to the requirements of the Contract Documents. This bid item includes anchorage, anchorage design, all necessary appurtenances required to install a new control panel on the existing concrete structure. Payment for this bid item shall be on a lump sum basis.

38. Webster Street Service Pedestal and Concrete Pad

    This bid item includes all labor, materials, and equipment necessary to furnish and install a fully functional electrical service and pedestal at the Webster Street Pump Station conforming to the requirements of the Contract Documents. This bid item includes all labor, materials, and equipment necessary to coordinate with the electrical utility and construct the improvements from the point of service connection to the service pedestal. This bid item also includes all necessary excavation, bedding, backfill, surface restoration, installation of a reinforced concrete equipment pad, anchorage, anchorage design, all necessary appurtenances required to install a new service pedestal and reinforced concrete equipment pad, and sidewalk replacement as necessary to construct the electrical service and pedestal. Payment for this bid item shall be on a lump sum basis.

39. Webster Street SCADA Antenna Mastarm

    This bid item shall constitute full compensation for all material, labor, equipment, tools, and services necessary to furnish and properly install SCADA antenna mastarm, grounding, conductors, conduits, and fittings as required in the Contract Documents. Also included in this bid item are all

fasteners necessary to secure the mastarm to the existing concrete pad. Payment for this bid item will be on a lump sum basis.

40. Webster Street Handrail

This bid item includes all labor, materials, tools, equipment, and incidentals to furnish and install handrail. This bid item also includes anchorage, hardware required to secure handrail to concrete pad, and restoration as necessary to install handrail. Payment for this bid item will be on a lump sum basis.

41. Webster Street Site Restoration and Cleanup

The lump sum bid price for this item constitutes full payment for all materials, equipment, and labor necessary for the reconstruction of curbs, gutters, sidewalks, irrigation, landscaping, and other improvements damaged or modified during construction and to leave the project site in a clean and fully usable condition upon job acceptance by the City. This bid item includes all other items as indicated on the Contract Documents and as necessary for construction of the improvements.

42. Webster Street Miscellaneous Electrical Work, Wiring, and Sensors

This bid item includes all materials, equipment, and labor necessary to modify and replace existing electrical wiring and sensors as required to provide a fully functioning electrical system conforming to the Contract Documents. Work includes, but is not limited to, supply and installation of conduits and conductors; supply, installation and calibration of sensors and electrical devices; wiring, lighting, and any additional work required to provide a fully functional system. This bid item also includes all necessary excavation, bedding, backfill, AC pavement replacement, sidewalk replacement, and other items as necessary to construct the improvements. Payment for this bid item shall be on a lump sum basis.

1.05 CONTRACTOR'S COST BREAKDOWN

A. The Contractor shall submit a Schedule of Values to the City's Representative at the preconstruction conference. The price breakdown, as agreed upon by the Contractor and the City's Representative, shall be used for preparing future estimates for partial payments of lump sum items to the Contractor.

B. The price breakdown shall be generally in the same format as the Contract specifications divisions and subdivisions, with major items of work listed individually. The price breakdown shall be by structural, civil, electrical, or other logical division of work. The price breakdown shall include separate allowances for any testing and startup work required. Measurable approximate quantities of work performed by the Contractor or its subcontractors shall be provided. For quantities that are the sum total of several individual quantities, backup summaries shall be provided which list the individual descriptions and quantities. These summaries then will be used to determine the quantities of work in place in subsequent progress payment requests.

C. The above is a statement of the intent of the Contract Documents to provide a moderate level of detail, acceptable to the City, to allow a fair and reasonable

estimate to be made of the value of work installed. The detail of the price breakdown must be sufficient to provide timely processing of the monthly progress payment request.

D. The price breakdown will be subject to the approval of the City, and upon request, the Contractor shall substantiate the price for any or all items and provide additional level of detail, including quantities of work. The price breakdown shall be sufficiently detailed to permit its use by the City as one of the bases for evaluating requests for payments. The City shall be the sole judge of the adequacy of the price breakdown.

E. The Schedule of Values shall be solely used to determine progress payments. The Schedule of Values shall not be considered in determining payment or credit for additional or deleted work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

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SECTION 01140
WORK RESTRICTIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for sequencing and scheduling the Work affected by existing site and facility, work restrictions and coordination between construction operations and plant/facility operations, including:

1. Access to site.
2. Use of site.
3. Use of premises.

B. Related Sections:

1. Section 01110 - Summary of Work.
2. Section 01145 - Contractor's Use of the Premises.
3. Section 01330 - Submittal Procedures.
4. Section 01500 - Temporary Facilities and Controls.

1.02 HOURS OF WORK

A. Refer to the Special Provisions for restrictions on hours of work.

1.03 SPECIFIC CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

A. Storm Water Projects:

1. The existing storm water pump stations, their force mains, outfalls, and upstream gravity systems are integral and important components of the storm water collection system for the City of Alameda.
2. Conduct work in a manner that will not impair the safe conveyance of storm water influent at each station to the downstream receiving water. Impairing the discharge of storm water in such a manner that results in reduced water quality or flooding will result in serious environmental damage and monetary fines. Influent storm water must be receiving water at all times during construction. This may require the use of temporary bypass facilities as required and as specified herein.
3. Include costs in bid price for compliance with the specific limitations and constraints and the related general factors pertaining to maintaining the discharge of all influent storm water.

B. Seasonal Restrictions:

1. All work which causes a pump station to be shut down for any period of time shall be performed during the Dry Season (April 15th through October 15th).

2. All pump stations shall be fully operational prior to the start of the Wet Season (October 15).

3. In the event that the existing or new equipment is not operational during the Wet Season, the Contractor shall provide temporary equipment (controls, power, sensors, etc.) as necessary to operate and control the existing pumps.

C. Improvements Must be Protected During and After Installation

1. Equipment installed as part of the Work shall be permanently secured against theft and vandalism and protected from the elements.

D. Work within Easements on Private Property

1. Approximate City easement locations are shown on the Drawings.

2. Contractor shall confine his non-transient operations to the existing easements. Contractor is responsible for obtaining permission from property owners for the use of any properties outside of the existing easements and street right of ways.

E. Work Sequence and Constraints:

1. Utilize description of critical events in work sequence in this Section as a guideline for scheduling and undertaking the Work.

2. Work sequence and constraints presented do not include all items affecting completion of the Work, but are intended to describe critical events necessary to minimize disruption of the existing facilities.

3. Indicate required closures of existing facilities or interruptions of existing operations on progress schedules submitted to the Engineer. Closures will be permitted to the extent that existing operation of the facilities will not be jeopardized and identified constraints are satisfied. All shutdowns and disruptions to operation of facilities shall be coordinated with the Engineer.

4. Submit written notification of required closures or disruptions to existing facilities at least 7 days prior to planned date of shutdown or disruption.

5. Do not begin alterations until Engineer's written permission has been received.

6. Minimize closures through advanced planning. Have required equipment, materials and labor on hand at time of closure.

1.04 ACCESS BY OTHER PARTIES

A. Provide access to the City and its representatives immediately upon request.

B. Provide safe and continuous access to all adjacent public and private properties at all times, unless specific written approval has been obtained to temporarily discontinue said access.

1.05 UTILITIES

A. Maintain electrical, telephone, water and other utilities within existing facilities in service. Provide temporary utilities when necessary.

B. Provide advance notice to and utilize services of Underground Services Alert (USA) for location and marking of underground utilities a minimum of five (5) days in advance of any activities that have the potential to encounter such utilities.

1.06 WORK BY OTHERS

A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

1.07 WORK SEQUENCE AND CONSTRAINTS

A. The following sequencing of work and/or constraints shall be adhered to by the contractor and shown in the progress schedule in accordance with the special provisions.

1. The CONTRACTOR shall be responsible for maintaining stormwater flow at all times. This may require temporary bypasses and/or dewatering to be constructed by the CONTRACTOR, as specified in Section 01500.
2. Upstream gravity lines shall not be allowed to surcharge such that water enters the street or gutters at any time during construction.
3. At least one lane of traffic shall be maintained on all streets where construction or construction traffic is occurring unless otherwise approved in writing by the City.
4. All work within the public right of way shall comply with the approved traffic control plan as specified in Section II.P of the Contract General Provisions.
5. Indicate required shutdowns of existing facilities on Progress Schedule. All shutdowns and disruptions to operation of facilities shall be coordinated with City operating personnel.
6. Submit written notification of required shutdowns or disruptions to existing facilities at least 7 days prior to planned date of shutdown or disruption.
7. Do not begin alterations or demolition until City’s written permission has been received.
8. Minimize shutdown duration through advanced planning. Have required equipment, materials and labor on hand at time of shutdown.
9. Coordinate between trades for proper installation/sequencing during pump station improvements.

1.08 TEMPORARY SERVICES, MATERIALS, AND EQUIPMENT

A. Locate temporary facilities in a manner that minimizes interference to City's operation and maintenance personnel.

B. Unless otherwise specified, install temporary pipelines of the same size as its connection to the existing facility at the downstream end of the pipeline.

C. Provide submittals on proposed temporary electrical and instrumentation components necessary to maintain existing facilities.

D. Dimensions for all existing structures, piping, paving, and other nonstructural items are approximate. The CONTRACTOR shall field verify all dimensions and conditions and report any discrepancies to the City a minimum of 14 days in advance of any construction in the area.

E. Discrepancies between coordinates, bearings and lengths, and stationing shall be resolved in the following order of precedence:

1. Coordinates.
2. Bearings and lengths.
3. Stationing.

1.09 UTILITIES

A. All work on this project shall be so conducted as to permit utility companies to maintain their services or install additional facilities without interruption.

B. Contractor shall, at his sole expense, make provisions for temporary pumping all flows into the pump stations and discharging to the force main or downstream receiving water whenever the pump station is inoperable, as shown on the plans and specified in Section 01500.

C. Work requires the installation of secondary electrical services from existing transformers. Contractor shall submit, in writing, notice to the City at least 48 hours in advance of his readiness for this necessary operation. Contractor shall cooperate fully with each of the affected utilities including Alameda Municipal Power (AMP).

D. Access to AMP secondary boxes is not allowed unless AMP personnel are present. Contact AMP Operation Center at 510-748-3964 during work hours, 8 AM – 4:30 PM Monday through Friday, to arrange access to AMP secondary boxes. Contractor shall notify AMP a minimum of 48 hours prior to access.

E. AMP inspectors are available from the hours of 8 AM to 4:30 PM Monday through Friday.

F. AMP will inspect electrical installations from the point of service to the meter, and City inspectors will perform inspections beyond the meter. Contractor shall schedule inspections accordingly.

1.10 INSPECTIONS

A. The Contractor shall schedule their work in a manner that allows inspections to be performed in accordance with the following inspection schedules.

B. AMP inspections shall be scheduled as described in the previous section.

C. City building department inspections shall be scheduled as follows:

1. Contractor shall call (510) 747-6800 between 7:30 AM and 8:30 AM, Monday to Thursday to schedule inspection.

2. The City's Building Dept. only performs scheduled inspections in "AM appointment" = 9 AM to 11:30 AM or PM appointment = between 1:00 PM to 3:30 PM. The building Department is closed on Fridays. Contractor shall schedule work and inspections accordingly.

D. Reference Section IV, H of the special provisions for the City's Public Works Inspection hours and requirements.

1.11 CONSTRUCTION SCHEDULE

A. The Contractor shall review the plans and specifications and submit a project schedule using the critical path method (CPM). The schedule shall be submitted for review at the preconstruction meeting. The schedule shall show the various activities of work in sufficient detail to demonstrate a reasonable and workable plan to complete the work in the specified contract time.

B. The CPM schedule shall include activities for all work to be performed by the Contractor and subcontractors. The schedule shall also include activities specific to the project to be performed by other parties, such as utility companies.

C. Construction shall not be started until the schedule is approved by the Engineer.

D. The Contractor shall not commence construction on any section of the work until such time that he shall have on the ground, or can furnish definite assurance to the Engineer that there will be available when required, all the materials necessary to complete the section of the work upon which construction is to begin.

E. The Contractor shall submit an updated work schedule at each progress meeting and upon the issuance of any change order that alters the contract's schedule.

1.12 BAY CONSERVATION AND DEVELOPMENT COMMISSION (BCDC) PERMIT

A. The City has applied for and obtained a BCDC Regionwide Permit No. RWP-2 for the work at the Webster Pump Station. A copy of the permit is included as Attachment D to these specifications. The Contractor is responsible for adhering to all requirements and restrictions identified in the BCDC permit.

B. The Contractor shall not proceed with any work at the Webster Pump Station until all permit requirements are met.

1.13 CITY OF ALAMEDA MARSH CRUST PERMIT

A. The 3rd Street Pump Station is located within the marsh crust/subtidal zone. Prior to performing excavations at this location the Contractor shall apply for and obtain a Marsh Crust Permit from the City of Alameda. Contractor shall adhere to all permit requirements. A copy of the permit application is provided as Attachment G to these specifications.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01145
CONTRACTOR'S USE OF THE PREMISES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for working in and around Project site, and protection of existing improvements, including:

1. Access to site.
2. Use of site.
3. Use of premises.
4. Protection of existing improvements to remain.
5. Public Safety.

B. Related Sections:

1. Section 01110 - Summary of Work.
2. Section 01140 - Work Restrictions.
3. Section 01500 - Temporary Facilities and Controls.

C. This Section applies to all situations in which the Contractor or his representatives, including but not necessarily limited to, suppliers, Subcontractors, employees and field engineers, enter upon the City's property, adjacent private properties, or utilize the public right-of-way for purposes other than conveyance.

D. Contractor shall commence the Contract Work and provide security and protection to the existing facility and job site within 5 days from the issuance of the "Notice to Proceed".

1.02 ACCESS TO THE JOB SITE

A. Restrict Contractor's employees to the immediate work areas on the job site and in no way go beyond the Work limits noted on the Drawings or as otherwise directed by the Engineer.

1.03 CITY OCCUPATION OF THE PREMISES

A. The City will not occupy the existing premises during construction operations.

1.04 CONTRACTOR'S USE OF THE PREMISES

A. Do not interfere with Pump Station operations of the City during Contracted Work operations.

B. All items, materials and equipment remaining in the existing structures and on the premises (job site), which are not specified to be salvaged or incorporated into the Contracted Work, shall become the property of the Contractor and shall be removed from the job site. The City makes no claims or assumes any value in any of these items, materials and/or equipment if they are removed from the structures or the job site or vandalized prior to and/or during the Contract period. The City assumes no responsibility for any additional operation or works as a result of the conditions described herein.

1.05 RIGHTS OF WAY

A. Outside of the work areas identified on the Drawings, the Contractor shall not allow its employees to use private property for any reason, or to use water or electricity from such property without written permission from each affected property owner. The Contractor shall provide evidence of such permission, in writing, to the Engineer, before entering upon such lands.

B. The Contractor shall be fully responsible for locating and obtaining permission to use layout and staging sites beyond those shown on the Drawings. Where the Contractor may find it advantageous to use private property, it shall arrange for such use and assume full responsibility for its rental, preparation, maintenance, and cleanup in a manner satisfactory to the City and property owner.

1.06 PARKING

A. No parking of Contractor's vehicles will be allowed on the job-site except for the purposes of active unloading and/or loading. Contractor shall not use new paved areas for loading or unloading. All traffic controls in the Work area shall conform to Section II.P of the Contract General Provisions.

B. Contractor's employees are advised to park within the adjacent private parking lot or city streets and shall observe all posted parking restrictions.

1.07 SECURITY

A. The Contractor shall be responsible for the security of all its construction equipment, materials, tools, facilities, and vehicles (personal, private, or contractual) while performing the work of this Contract. This requirement shall be effective twenty-four (24) hours per day for the entire duration of the Contract.

B. Contractor shall furnish and maintain approved type site security protection between the Work areas and other areas. All such site security protection shall remain for the duration of this Contract.

1.08 PROTECTIONS

A. Where necessary for the safety of the public and the protection of the adjacent street improvements and adjacent properties, provide and maintain adequate protections, fences and gates and barricades to separate Work areas from areas outside the job site limits. Such protections shall comply with provisions of

Section 01500 "Temporary Facilities and Controls", and shall remain in place during extent of this Contract or as otherwise directed by the Engineer.

B. Provide protections, barricades, signs, etc., as necessary so that persons will be protected from the Work areas where trenching and excavations occur on the job site. Upon completion of such work operations, such protections shall be removed. Such protections shall not unnecessarily disrupt the public right-of-way at the job site.

C. All equipment, material, soil, debris and any heavy loaded object that will not become part of the permanent Work shall only be temporarily stock piled within the work area, and shall be removed from the site as quickly as feasible.

D. Protection of Existing Structures and Site Conditions:

1. Protect existing surfaces in areas where work of this Contract is being performed or passed through for access to the Work areas from damage in a manner approved by the Engineer. Take all necessary precautions to protect and preserve the integrity of all existing work. Submit protection plans or details as required by the Engineer.

2. Provide adequate protection for existing wall, fencing, post or sign, lighting, plant, traffic signal equipment including loop detectors, paving, etc. indicated to remain within the Work area. Contractor shall make necessary repair to damages that occurred under Contractor's responsibility or jurisdiction.

1.09 REPAIR OF DAMAGES

A. Repair or replace any damage to existing structures or equipment under Contractor's protection.

B. Repair or replace damaged work with new materials as necessary to restore the damaged areas or surfaces to a condition equal to and matching such conditions existing prior to damage or start of Work at no added cost to the City.

C. Submit repair method for approval as required by the Engineer.

1.10 INTERRUPTION OF SERVICES

A. Contractor shall make all provisions to accomplish all Work without undue interference with the City's operations of the existing facilities or utilities on the job site premises. Any necessary interruptions to existing facilities shall be done only after 48 hours advance consultations with the Engineer and at such time and duration as instructed by the Engineer.

1.11 NON-INTERFERENCE WITH OTHERS

A. Confine Work operations to the immediate boundaries of the job site and execute Work operations in a manner to minimize interference with City operations and/or work operations of other contractors.

B. Provide and maintain adjacent pedestrian and vehicular accesses in accordance with the Contract General Provisions.

C. Obtain approval of the Engineer prior to any street or parking lot closure.

1.12 UNDERGROUND SERVICE ALERT

A. Before commencing any excavation, the Contractor shall obtain an underground service alert inquiry I.D. Number by calling (800) 227-2600. Five (5) working days shall be allowed after the I.D. Number is obtained and before the excavation work is started so that utility owners can be notified.

1.13 JOB SAFETY

A. Observe all safety rules and regulations of the applicable Building Code and CAL/OSHA as applicable to the safety of the Contractor, Contractor's personnel and City employees during Work operations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01150
STORAGE OF MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for storing materials and equipment on and off-site as necessary for the prosecution of the Work.

B. Related Sections:

1. Section 01145 - Contractor's Use of Premises.
2. Section 01330 - Submittal Procedures.
3. Section 01500 - Temporary Facilities and Controls.

1.02 REQUIREMENTS

A. Protection of Work and Materials

1. Provide and maintain storage facilities and employ such measures as will preserve the specified quality and fitness of materials to be used in the Work. Stored materials shall be reasonably accessible for inspection. Adequately protect new and existing work and all items of equipment for the duration of the Contract.
2. The Contractor shall not, without the City's consent, assign, sell, mortgage, hypothecate, or remove equipment or materials which have been installed or delivered and which may be necessary for the completion of the Contract.

B. Material Delivery

1. The Contractor, subcontractors, and suppliers shall at all times comply with the requirements of the City of Alameda Truck Route Ordinance and the City of Oakland Truck Route Ordinance.
2. As much as possible, material delivery should be completed before 10 am.
3. Contractor shall submit the following for review in advance of the first scheduled material delivery:
    a. Vicinity maps showing the project location and proposed truck access routes.
    b. An estimation of the frequency of delivery trucks during each phase of construction.
    c. Traffic control plans for truck delivery operations in conformance with Section II.P of the Contract General Provisions.

C. Storage of Equipment and Materials on Site

1. To the maximum extent possible, construction materials and equipment shall be stored on site within an area secured by the Contractor inside the limits of site occupation indicated on the Drawings.
2. On-site equipment and material storage shall occur within the areas designated as exclusive and non-exclusive easements on the Drawings, unless written arrangements are made with the City.

D. Storage of Equipment and Materials in Public Streets

1. No storage of materials, facilities, or equipment is permitted in City sidewalks, streets, or parking lots, unless approved by the City. This includes sanitation facilities, office trailers, dumpsters, and storage containers.
2. If City parking lot use is approved, costs for parking space rentals will be assessed and additional bonding required.
3. Notwithstanding the above criteria, construction materials shall not be stored in streets, roads, or highways for more than five (5) calendar days after unloading. All materials or equipment not installed or used in construction within five (5) calendar days after unloading shall be stored elsewhere by the Contractor at its expense unless authorized additional storage time. Equipment and materials shall not obstruct pedestrian or vehicular traffic, traffic lines of sight, or drainage paths.
4. Construction equipment shall not be stored at the Worksite before its actual use on the Work nor for more than five (5) calendar days after it is no longer needed. Time necessary for repair or assembly of equipment may be authorized by the Engineer.
5. Excavated material, except that which is to be used as backfill in the adjacent trench, shall not be stored in public streets unless otherwise permitted. After placing backfill, all excess material shall be removed immediately from the site.
6. The Contractor shall be fully responsible for locating and obtaining permission to use stockpile sites.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01330
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements and procedures for submitting Shop Drawings, Product Data, Samples, other submittals relating to products, and as specified in individual sections.

1.02 DEFINITIONS

A. Manufacturer's Instructions: Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product; Manufacturers Instructions are not prepared especially for the Work.

B. Shop or Fabrication Drawings: Drawings, diagrams, schedules, and other data specially prepared for the Work to illustrate some portion of the Work in detail sufficient for actual fabrication.

C. Design Calculations: Detailed calculations relating to structural, mechanical, or electrical design as called for in the relevant technical specification section, or as necessary for the preparation of detailed fabrication drawings.

D. Product Data: Illustrations, standard schedules, performance charts, brochures, diagrams and other information to illustrate materials or equipment for some portion of the Work.

E. Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

F. Special Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged, and will be incorporated in the Work.

1.03 SUBMITTAL PROCEDURES

A. Deliver submittals to the City’s representative via email. Contractor shall provide a file share site for transferring all submittals larger than 5MB.

1. Final hard copies of Operation and Maintenance manuals are required as specified in each individual specification section. Contractor shall also provide electronic submittal of all operation and maintenance manuals.

B. Submit submittals in ample time to serve submittals' intended purpose.

C. Submit submittals which are specified or reasonably required for construction, operation, and maintenance of the Work.

D. All submittals shall be accompanied by the standard “CONTRACTOR’S SUBMITTAL TRANSMITTAL” form (Section 1.04). Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, or are incorrectly completed, may be returned at the Engineer’s discretion for resubmittal

E. Provide or furnish products and execute the Work in accordance with accepted submittals, unless in conflict with Contract Documents.

F. When minor deviations from Contract Documents are accepted, modify Contract Documents in accordance with the Conditions of the Contract.

1.04 SUBMITTAL FORM

A. Each submittal transmittal form shall identify:

1. Submittal date.
2. Project and Contractor.
3. Subcontractor and major supplier, when appropriate.
4. Reference submittal to Contract Documents by Drawing, detail, and/or Specification section numbers, as appropriate.
5. Variations from Contract Documents when variations are included in submittal.

B. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates a review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the Engineer.

C. All submittal forms and submittals shall be in English.

1.05 SUBMITTAL LIST

A. Furnish a schedule and list of all required submittals to the Engineer at the Preconstruction Conference, including required submittals by all subcontractors.

B. Regardless of the Engineer’s acceptance of such a submittal list, Contractor shall furnish all submittals required in the Technical Specifications.

1.06 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Submit Shop Drawings, Product Data, Samples, and other pertinent information in sufficient detail to show compliance with specified requirements.

B. Shop Drawings shall show in detail the size, sections, and dimensions of all the member(s); the arrangement and construction of all connections and joints; all holes, straps, and other fittings required for attaching work and other pertinent

details. When required, engineering computations shall be submitted. The Contractor shall be responsible for delivering reviewed copies of Shop Drawings to all others whose work is dependent thereon.

C. The Contractor shall maintain at the site of the Project, at all times, a complete file of approved Shop Drawings and manufacturers' data for this Project.

D. Check, verify, and revise submittals as necessary to bring them into conformance with Contract Documents and actual field conditions.

1. Determine and verify quantities, dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.

2. Coordinate submittal with other submittals and with the requirements of the Contract Documents.

E. After completion of checking, verification, and revising; stamp, sign and date submittals indicating review and approval; and submit to Engineer.

1. Stamp and signature indicates Contractor has satisfied shop drawing review responsibilities and constitutes Contractor's written approval of shop drawing.

2. Shop drawings without Contractor's written approval will be returned for resubmission.

F. Product Data and Manufacturer's Instructions: Submit electronic copies of review submittals, and four (4) hard copies of final approved submittals if requested by the City. Excise or cross out non-applicable information and clearly mark applicable information with citations to and terminology consistent with Contract Documents.

G. Samples: Submit two (2) samples labeled with reference to applicable Contract Documents. Label will be returned with reviewer's selection when appropriate, comments, and stamp. Samples will not be returned unless return is requested in writing and additional sample is submitted.

H. Special Samples: Submit one (1) sample labeled with reference to applicable Contract Documents. Sample and one label will be returned for installation in the Work.

I. Assume risk of expense and delays when proceeding with work related to required submittals without review and acceptance.

1.07 MANUFACTURER'S INSTRUCTIONS

A. Submit manufacturer's instructions whenever made available by manufacturers and when installation, erection, or application in accordance with manufacturer’s instructions is required by the Specifications.

B. Submit manufacturer's instructions prior to installation, erection, or application of equipment and other project components. Submit manufacturer's instructions in accordance with requirements for Product Data.

1.08 CERTIFICATES OF COMPLIANCE

A. Certificates of Compliance should provide the following information:

1. Name of supplier;
2. Type of material being supplied and quantity of material available;
3. A statement that material being supplied complies in all respects with the requirements of the specifications;
4. Copies of test results from a qualified testing laboratory which supports the statement provided above.

B. All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time by the Engineer. The fact that material is used on the basis of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Drawings and Specifications and any such material not conforming to such requirements will be subject to rejection whether in place or not.

1.09 ENGINEER'S REVIEW

A. Engineer's review of submittals shall not release Contractor from Contractor's responsibility for performance of requirements of Contract Documents. Neither shall Engineer's review release Contractor from fulfilling purpose of installation nor from Contractor's liability to replace defective work.

B. Do not consider submittals as Contract Documents. Purpose of submittals is to demonstrate how Contractor intends to conform to the design concepts.

C. Engineer's review of shop drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents.

1. Engineer's review does not extend to:
    a. Accuracy of dimensions, quantities, or performance of equipment and systems designed by Contractor.
    b. Contractor's means, methods, techniques, sequences, or procedures except when specified, indicated on the Drawings, or required by Contract Documents.
    c. Safety precautions or programs related to safety which shall remain the sole responsibility of the Contractor.

D. Except as may be provided in subsequent specifications, a submittal will be returned within 30 days with appropriate comments if required.

1. When a submittal cannot be returned within that period, Engineer will, within a reasonable time after receipt of the submittal, give notice of the date by which that submittal will be returned.

E. Engineer will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.

F. Costs incurred by City as a result of additional reviews of a particular submittal after the second time it has been reviewed shall be borne by Contractor. Reimbursement to City will be made by deducting such costs from Contractor's subsequent partial payments.

1.10 SUBMITTAL REVIEW PROCEDURES

A. It is considered reasonable that the Contractor shall make a complete and acceptable submittal to the Engineer by the second submission of a submittal item. The City reserves the right to withhold moneys due the Contractor to cover additional costs of the Engineer’s review beyond the second submittal. Submittal will be returned to the Contractor with one of three (3) markings:

1. If submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN/PROCEED," formal revision and resubmission of said submittal will not be required.

2. If submittal is returned to the Contractor marked "MAKE CORRECTIONS NOTED/PROCEED CONDITIONALLY" formal revision and resubmission of said submittal will not be required.

3. If submittal is returned to the Contractor marked "REJECTED-RESUBMIT/DO NOT PROCEED," the Contractor shall revise said submittal and shall resubmit to the Engineer.

B. All Work for which Shop Drawings are required shall be performed in accordance with the reviewed and approved copies. Fabrication of an item shall not commence before the Engineer has reviewed the pertinent submittal and returned the copies to the Contractor marked either "NO EXCEPTIONS TAKEN/PROCEED," or "MAKE CORRECTIONS NOTED/PROCEED CONDITIONALLY.” Revisions indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for claims for extra work.

C. All Contractor submittals shall be carefully reviewed by an authorized representative of the Contractor prior to submission to the Engineer. Each submittal shall be dated, signed, and certified by the Contractor as being correct and in strict conformance with the Contract Documents. No consideration for review by the Engineer of any Contractor’s submittal will be made for any items which have not been so certified by the Contractor. All noncertified submittals will be returned to the Contractor without action taken by the Engineer, and any delays caused thereby shall be the total responsibility of the Contractor.

D. Should the Shop Drawings or manufacturers data (for submittals required by the Standard Specifications or the specifications) show variations from the Contract requirements, the Contractor shall make specific mention of such variations in the letter of transmittal, in order that, if acceptable, suitable action may be taken

for proper adjustment of the Contract; otherwise the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract Documents, and the approved submittals.

1.11 MINOR OR INCIDENTAL PRODUCTS AND EQUIPMENT SCHEDULES

A. Shop Drawings of minor or incidental fabricated products will not be required, unless requested.

B. Submit tabulated lists of minor or incidental products showing the names of the manufacturers and catalog numbers, with Product Data and Samples as required to determine acceptability.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01354
HAZARDOUS MATERIALS CONDITIONS AND PROCEDURES

PART 1 GENERAL

1.01 DESCRIPTION

A. Section includes description of existing site conditions, general requirements, and procedures for work in the presence of hazardous materials, and requirements for personal protective equipment, training, and monitoring.

B. Requirements of this section apply to the Work or any portion thereof which involves disturbance of or exposure to hazardous materials.

1.02 DEFINITIONS

A. Hazardous Materials: Materials consisting of or containing any substances defined, regulated or listed as hazardous substances, hazardous materials, hazardous wastes, health hazards, toxic waste, pollutant or toxic substances or similarly identified as hazardous to human health or the environment in or pursuant to CERCLA, the Hazardous Materials Transportation Act, RCRA, the Clean Water Act, California Health and Safety Code, the Clean Air Act, the California Water Code or any other appropriate regulation or law including without limitation friable asbestos, polychlorinated biphenyls, petroleum, natural gas and synthetic fuel products and by-products.

B. Personal Protective Equipment (PPE): Individually donned equipment and clothing used in conjunction with appropriate engineering controls and work practices to protect project workers from unacceptable risk related to the handling of soil, building material, or groundwater impacted with hazardous materials.

C. Training and Personnel Monitoring – Labor, materials, equipment, and analyses, utilized to provide appropriate baseline and ongoing training, communication, and verification, including medical surveillance (if needed), of conditions related to employee exposure to hazardous materials.

D. Hazardous Materials Site-Specific Health and Safety Plan (HMSSHASP): A site-specific plan which addresses the safety and health hazards of each phase of site operations and includes the requirements and procedures for employee protection.

E. Contaminated Materials:

1. Contaminated Soil: Soil that cannot be disposed of at a Class III landfill/disposal site.

2. Contaminated Water: Ground water from dewatering operations containing constituents at measured levels in excess of permit thresholds for discharge into the sanitary sewer system.

3. Contaminated Sludge: Sludge, sediment and debris removed from the storm drain facilities that cannot be disposed of at a Class III landfill/disposal site.
4. Site materials, whether existing or new, other than soil or water that cannot be disposed of at a Class III landfill/disposal site shall also be considered as contaminated material.

1.03 SUBMITTALS

A. Hazardous Materials Site-Specific Health and Safety Plan (HMSSHASP): Submit for acceptance by the Engineer within 21 days after Notice to Proceed.

B. Amendments: Submit amendments to the HMSSHASP for review and acceptance by the Engineer as they occur.

C. Contaminated Soil Excavation and Disposal Work Plan (CSEDWP):

1. The CONTRACTOR shall prepare and submit to the ENGINEER for approval a CSEDWP. The plan shall be approved prior to beginning any excavation work.
2. The CSEDWP shall address the management of contaminated soils and ground water that may be encountered during the prosecution of the Work. All contaminated material encountered in work areas shall be disposed of at a landfill/disposal site approved for the type of material encountered.
3. The CSEDWP shall address removal and disposal procedures for contaminated soils encountered along the pipeline alignments. The Plan will provide, at a minimum, the following information:
    a. The name(s) and address(es) of Subcontractor(s) for work of this Section.
    b. As discussed in 2.01, the methodology for all waste tracking activities to prevent the occurrence of cross contamination; excavation methods detailing operations necessary to ensure no blending of contaminated soil with non-contaminated soil; and temporary stockpiling methods.
    c. Corporate name, address, and contact person information (name, telephone, and fax number) of all hazardous waste transporters. Include proof of current permit, license, and/or authorization to transport hazardous waste within the state.
    d. Disposal facility information described in 2.01 herein.
    e. The CONTRACTOR shall submit documentation certifying that all contaminated materials were transported to, accepted, and disposed of, at the disposal facility.

1.04 EXISTING SITE CONDITIONS

A. The work sites are operating storm water pump stations located within an urban area. It is unknown but possible that hazardous materials may be found or have been used within the Work site.

B. Analytical soil and groundwater testing was performed at the 3rd Street Pump Station site. The analytical testing report is included as Attachment F to these specifications. The Contractor shall utilize the results of the analytical testing as a basis for bidding to estimate the removal and disposal costs of the existing soil and groundwater. Reference Section 02300 for additional requirements.

C. Contaminated Material:

1. The existing force main to be removed at the 3rd Street Pump Station is has an asbestos wrap. Reference Section 02170 for removal requirements.
2. The Contractor may encounter contaminated materials (as defined herein) on work site surfaces or within equipment that may be abandoned on-site or demolished and removed from site.
3. The City is not aware of substantial contamination at these Work sites other than what is listed herein; however, given the historic use of the facilities, contaminated material could include asbestos cement (AC) pipes, lead-based paint, residual solvents, and petroleum hydrocarbons from maintenance activities.

1.05 GENERAL REQUIREMENTS

A. No work that disturbs existing structures, soil, or groundwater containing hazardous materials shall be performed until the Hazardous Substance Site-Specific Health and Safety Plan is reviewed and accepted by the Engineer.

B. Documentation:

1. Maintain logs on-site of monitoring equipment calibration.
2. Maintain logs on-site of the results of field monitoring measurements.
3. Maintain copies on-site of any laboratory analytical results associated with health and safety monitoring.

C. Contractor shall comply with the following general work practices:

1. Do not smoke, chew gum, apply cosmetics, or consume food and beverages in areas where hazardous materials are being handled.
2. Wash hands thoroughly before eating, smoking, or drinking.
3. Do not store food in areas where it may come in contact with hazardous materials, including soil and dusts.
4. To the extent practical, stay upwind from operations that emit vapors, gases, or particulates.
5. Clean clothing and footwear upon leaving jobsite and prior to entering any vehicle, mobile equipment, or office.
6. Clean vehicle interiors and hand held tools as needed to prevent accumulation of particulates.

D. Follow guidelines for the selection and use of proper personal protective equipment as outlined in the applicable job safety or task hazard analysis from

the Hazardous Material Site Specific Health and Safety Plan. At a minimum all Contractor personnel that may come into contact with site soils shall be suitably dressed to perform their work in a safe manner that minimizes exposure to soil and does not interfere with their hearing, vision, or free use of their hands or feet. The following minimum PPE shall be worn by all Contractor employees who may come into contact with site soils:

1. Waist length shirts with sleeves.
2. Trousers covering the entire leg.
3. Work boots.
4. Eye protection meeting the latest American National Standard for Occupational and Educational eye and face protection.
5. Work gloves when handling soil or hand tools in contact with soil.
6. Additional equipment may modify this minimum requirement and, if required, will be outlined in the Hazardous Material Site Specific Safety and Health Plan as part of the job safety or task hazard analysis.

E. Use equipment, in addition to the minimum outlined herein, if listed in the Hazardous Material Site Specific Safety and Health Plan as part of the job safety or task hazard analysis.

1.06 HAZARDOUS MATERIALS SITE-SPECIFIC HEALTH AND SAFETY PLAN

A. Prepare a Hazardous Materials Site-Specific Health and Safety Plan (HMSSHASP) for all site personnel in accordance with the federal OSHA, and Cal/OSHA regulations.

1. The Plan shall include:

a. Provisions specific to handling soils and ballast containing elevated concentrations of petroleum hydrocarbons, poly-nuclear aromatic hydrocarbons, and the metals lead and arsenic.

b. Additional information or procedures as determined necessary by the Contractor for safe performance of work in the presence of hazardous materials.

B. Implement the HMSSHASP, including use of engineering controls, providing its site personnel with the appropriate training and monitoring and personal protective equipment (PPE) based upon the type of work to be performed and the associated hazard, and ensuring proper use of PPE and compliance with safe work practices. The Contractor shall perform all monitoring necessary to determine the ongoing appropriate level of PPE for the work.

C. The Engineer will have the authority to stop work if, in the opinion of the Engineer, the level of PPE selected by the Contractor is not appropriate or site personnel are not complying with the requirements of the HMSSHASP.

1.07 UNKNOWN HAZARDOUS MATERIALS

A. When the presence of hazardous materials are not indicated in the Contract Documents and the Contractor encounters materials, including groundwater, which the Contractor reasonably believes to be hazardous and the hazardous materials have not been rendered harmless, the Contractor shall immediately cease work in the affected area and report the condition to the Engineer in writing. The Contractor may continue work in unaffected areas reasonably believed to be safe.

B. The Engineer will direct the Contractor as to sampling, testing, disposal, and/or remedial work that might take place either through the Contractor's forces or City's own forces or an authorized agent. If the consequent delay of work in the affected area delays a current controlling operation, the delay will be considered in accordance with Section 6-6 of the Standard Specifications as modified by the Special Provisions.

PART 2 PRODUCTS

2.01 CONTAMINATED SOILS

A. The CONTRACTOR shall perform all work of this Section in accordance with the Construction Safety Plan. The Construction Safety Plan shall contain the information listed below.

B. Construction Safety Plan

1. Detail the Methods and Procedures to comply with California Labor Code Section 6401.7, Federal, and Local Health and Safety Laws, Rules and Requirements for the duration of the Contract Times. Include the following:

   a. Identification of the certified or licensed safety consultant, who will prepare, initiate, maintain and supervise safety programs, and procedures.

   b. Procedures for providing workers with an awareness of safety and health hazards expected to be encountered in the course of construction.

   c. Safety equipment appropriate to the safety and health hazards expected to be encountered during construction. Include warning devices, barricades, safety equipment in public right-of-way and protected areas, and safety equipment used in multi-level structures.

   d. Methods for minimizing employees' exposure to safety and health hazards expected during construction.

   e. Procedures for reporting safety or health hazards.

   f. Procedures to follow to correct a recognized safety and health hazard.

   g. Procedures for investigation of accidents, injuries, illnesses and unusual events that have occurred at the construction site.

h. Periodic and scheduled inspections of general work areas and specific work stations.

i. Training for employees and workers at the jobsite.

j. Methods of communication of safe working conditions, work practices and required personal protection equipment.

2. Assume responsibility for every aspect of Health and Safety on the jobsite, including the health and safety of subcontractors, suppliers, and other persons on the jobsite.

a. Employ additional health and safety measures specified by the Safety Consultant, as necessary, for workers in accordance with OSHA guidelines.

3. Transmit to CITY and ENGINEER copies of reports and other documents related to accidents or injuries encountered during construction.

C. On all portions of the work involving grading or excavation, the CONTRACTOR shall examine soil as evidenced by site history, discoloration, odor, differences in soil properties, abandoned underground tanks or pipes, or buried debris.

1. If the project is not within an area of known soil contamination and no evidence of soil contamination is found, then testing of the soil will only be required if directed by the ENGINEER. The CONTRACTOR shall follow the paragraphs below, if contamination is suspected or found.

2. If the work is within an area of known soil contamination or evidence of soil contamination is found, then soil from grading or excavation operations shall be tested.

a. The soil shall be managed as required by the governing agencies.

b. The CONTRACTOR shall test excavated material suspected of contamination for disposal characteristics.

c. All confirmation and stockpile soil samples for testing shall be submitted to a State-certified analytical laboratory for chemical analysis.

3. If the project is found to be within an area of soil contamination not identified by the CITY in the Contract Documents, a change order shall be negotiated to cover additional work performed by the CONTRACTOR.

D. During excavation, if the CONTRACTOR encounters contaminated soil, the CONTRACTOR shall immediately implement the CSEDWP. Any non-contaminated soil that becomes mixed with contaminated soil shall be designated as contaminated and shall be handled and disposed as such at no additional cost to the CITY. CONTRACTOR will not be paid for handling and disposal of the volume of non-contaminated soil at the contaminated soil price, if it is mixed with contaminated soil.

E. The CONTRACTOR shall temporarily stockpile excavated soil in piles not exceeding a volume of 500 cubic yards pending soil characterization and analytical results. Stockpiles shall be securely barricaded and clearly labeled.

Excavated material will not have to be segregated into different stockpiles for sampling and disposal. However, if a clearly segregable material is encountered (railroad ballast or other soil that is stained, odorous, or discolored) the material shall be stockpiled separately and sampled for disposal characteristics.

F. Contaminated soils stored at the temporary stockpile area shall be covered with visqueen material to prevent the migration of contaminants from the material. CONTRACTOR shall provide temporary berms constructed of clean soil or hay bales and covered with visqueen to contain runoff from the stockpiled soil. Visqueen material shall have a thickness of at least 10 milli-inches. CONTRACTOR shall recover all rainwater or other water that collects in the temporary stockpile area.

G. The CONTRACTOR shall implement a material tracking system to track all contaminated soil between collection, excavation, stockpiling or storage, sampling and testing, and final disposition. The waste tracking system shall include identification of the source of the soil (location, depths, and date of excavation) and stockpile or storage location.

1. The CONTRACTOR shall identify a minimum of one landfill that is permitted to and will accept the contaminated soils expected for disposal. The CONTRACTOR shall select landfills that are established, fully operational, and in full compliance with all applicable federal, state, and local regulations.

H. All construction equipment used for the handling of contaminated material shall be decontaminated prior to use for other work elements or removal from site.

2.02 CONTAMINATED WATER

A. The CONTRACTOR shall perform all work of this Section in accordance with the Construction Safety Plan described in this specification.

B. The CONTRACTOR shall contain and properly dispose of all water generated from excavation work in contaminated areas, as described in this Section.

C. The CONTRACTOR shall test excavated ground water for disposal characteristics. The CONTRACTOR shall allow the suspended particles to settle out of solution prior to testing water. Water samples taken during initial studies included suspended particles that contained metals. All confirmation samples will be submitted to a State-certified analytical laboratory for chemical analysis.

D. During excavation operations, if the CONTRACTOR encounters contaminated water, the CONTRACTOR shall immediately implement the CSEDWP. Any non-contaminated water that becomes mixed with contaminated water shall be designated as contaminated water and shall be handled and disposed as such at no additional cost to the CITY. CONTRACTOR will not be paid for handling and disposal of the volume of non-contaminated water at the contaminated price, if it is mixed with contaminated water.

E. The CONTRACTOR shall temporarily store water from dewatering activities pending water characterization and analytical results. Stored water shall be clearly labeled. Contractor shall install in-line filtration system prior to disposal for water if required by disposal facility.

F. The CONTRACTOR shall identify a minimum of one disposal site that is permitted to and will accept the contaminated water expected for disposal. The CONTRACTOR shall select facilities that are established, fully operational, and in full compliance with all applicable federal, state, and local regulations.

G. All construction equipment used for the handling of contaminated material shall be decontaminated prior to use for other work elements or removal from site.

PART 3 EXECUTION

3.01 Hazardous Materials Indemnity

A. From and after CONTRACTOR undertakes work on the property subject to this Agreement, CONTRACTOR shall indemnify, defend (with counsel selected by CITY) and hold harmless CITY, from and against all Liability concerning CONTRACTOR's operations on said property. CONTRACTOR and CITY agree that upon receipt of any notices of a release or potential release of Hazardous Materials during work on the property subject to this Agreement or transportation to or from the disposal facility at which the hazardous soils may be placed, the parties will provide prompt notice to the other. CONTRACTOR shall timely initiate and diligently pursue and complete all appropriate response, remediation and removal actions for the release, within the deadlines specified by applicable laws and regulations.

B. So long as CONTRACTOR is not in material breach hereof, and is discharging its defense and indemnity obligations in a reasonable and responsible manner for a Liability, and it has accepted and is discharging responsibility hereunder for such liability without any reservation of rights, CITY hereby assigns to CONTRACTOR all of its present and future rights to recover, or receive contribution, from any and all potentially responsible third parties for those costs, expenses and fees incurred by CONTRACTOR pursuant to this Indemnity. Subject to the foregoing, CITY hereby also assigns its rights to CONTRACTOR to bring an action against or otherwise cause any or all of such potentially responsible parties to take responsive actions, and to remove and remediate the Hazardous Materials. Each party agrees to cooperate fully with the other in the preservation and prosecution of all such claims and private enforcement actions.

C. So long as CONTRACTOR is not in material breach hereof, and is discharging its defense and indemnity obligations in a reasonable and responsible manner for a Liability, and it has accepted responsibility hereunder for such liability without any reservation of rights, CONTRACTOR shall have control over the defense of such Liability without any reservation of rights, and over all negotiations relating to the settlement thereof. CONTRACTOR's exercise of control over settlements shall not relieve CONTRACTOR of its indemnity and defense obligations to CITY.

3.02 HAZARDOUS MATERIAL AND WASTE MANAGEMENT

A. Storage: The CONTRACTOR shall label and store all hazardous materials, such as pesticides, paints, thinners, solvents, and fuels; and all hazardous wastes, such as waste oil and antifreeze; in accordance with all applicable local, State and Federal regulations.

1. The CONTRACTOR shall store all hazardous materials and all hazardous wastes in accordance with secondary containment regulations, and it is recommended that these materials and wastes be covered, as needed, to avoid potential management of collected rain water as a hazardous waste.

2. The CONTRACTOR shall keep an accurate, up-to-date inventory, including, but not limited to, Material Safety Data Sheets (MSDSs) of hazardous materials and hazardous wastes stored on-site, to assist emergency response personnel in the event of a hazardous materials incident.

B. Usage: When rain forecast within 24 hours or during wet weather, the Engineer may prevent the CONTRACTOR from applying chemicals in outside areas. The CONTRACTOR shall not over-apply pesticides or fertilizers and shall follow material manufacturer's instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.

C. Disposal: The CONTRACTOR shall arrange for regular hazardous waste collection to comply with time limits on storage of hazardous wastes. The CONTRACTOR shall dispose of hazardous waste only at authorized and permitted Treatment, Storage, and Disposal Facilities, and use only licensed hazardous waste haulers to remove the waste off-site, unless quantities to be transported are below applicable threshold limits for transportation specified in State and Federal regulations. CONTRACTOR shall ensure that CITY receives a copy of the Uniform Hazardous Waste Manifest form completed by the hazardous waste facility that accepted said materials.

END OF SECTION

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SECTION 01410
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. Building Codes and Regulations:

1. The Contractor shall perform the Contracted Work in accordance with the requirements of the California Building Codes and Amendments and all other regulations, laws, and ordinances, even though such requirements are not specifically mentioned in the Specifications or shown on the Contract Plans.

2. When the Work required by the Plans and Specifications are in conflict with any such law or ordinance, the Contractor shall notify the Engineer. The Contractor shall comply with the more stringent requirements, unless notified by the Engineer and the Contractor shall not proceed with the Work until the Engineer has so ordered.

3. This Section specifies procedural and administrative requirements for compliance with governing regulations, codes, and standards imposed upon the Contracted Work. These requirements include obtaining permits, licenses, inspections, releases, and similar documentation, as well as payments, statements, and similar requirements associated with the regulations, codes, and standards.

1.02 CODES AND REGULATIONS

A. The design and construction of this Project have been selected and depicted on the Contract Documents in compliance with all applicable codes, which govern the various work, materials, devices, equipment, systems, and procedures in effect at the time the Project is issued to bid by the City. These include, but are not limited to, the following:

1. City of Alameda "Standard Specifications for Public Works Construction".

2. City of Alameda “Standard Plans”

3. Alameda Municipal Power, Material, and Installation Criteria for Underground Electrical Systems.

4. Alameda City Municipal Code, latest edition.

5. San Francisco Bay Conservation and Development Commission (BCDC)

6. California Building Code (CBC).

7. CAL-OSHA (Occupational and Safety Code).

8. California State Fire Marshall requirements.

9. California Electrical, Plumbing, and Mechanical Codes.

10. State Energy Standards Title 24.

11. Americans with Disabilities Act (ADA).
12. Bay Area Air Quality Management District (BAAQMD).
13. East Bay Municipal Utility District (EBMUD) Ordinances and Waste Discharge Permit Requirements
14. All other Codes and Regulations that may be noted in the Technical Sections of the Specifications.

B. Contractor shall be familiar with all codes, regulations and all necessary procedures to obtain and pay for all permits, arrange all inspections, and secure necessary releases or sign-offs, which are prerequisite to any utility service connection work.

C. When conflict or violation of law or codes are found during any inspection by the governing agencies, the Contractor shall request such allegation of code conflict or violation, or Request of Correction to be on a written form from the governing agencies. The Contractor shall furnish the Engineer and the Inspector each a duplicate copy of such written notice for review.

D. Reference section 01140 for additional permit requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Furnishing, maintaining, and removing construction facilities and temporary controls, including temporary utilities, construction aids, barriers and enclosures, security, access roads, temporary controls, project signs, field offices and sheds, and removal after construction.

1.02 TEMPORARY UTILITIES

A. Temporary Electrical Power:

1. Arrange with Alameda Municipal Power (AMP) to provide adequate temporary electrical services or provide backup generators as required to complete the work.
2. Provide and maintain adequate jobsite power distribution facilities conforming to applicable Laws and Regulations.
3. Provide, maintain, and pay for electric power for performance of the Work.
    a. When using permanent facilities, provide separate meter and reimburse City for power used in connection with performance of the Work.

B. Temporary Electrical Lighting:

1. In work areas, provide temporary lighting sufficient to maintain lighting levels during working hours not less than lighting levels required by OSHA and state agency which administers OSHA regulations where Project is located.
2. When available, permanent lighting facilities may be used in lieu of temporary facilities.
    a. Prior to Substantial Completion of the Work, replace bulbs, lamps, or tubes used by Contractor for lighting.

C. Temporary Heating, Cooling, and Ventilating:

1. Heat and ventilate work areas to protect the Work from damage by freezing, high temperatures, weather, and to provide a safe environment for workers.

D. Temporary Water:

1. Pay for and provide facilities necessary to furnish potable water for human consumption and use during construction.
2. Pay for water used for construction prior to Completion.

3. The Contractor shall provide and maintain adequate drinking water facilities at locations easily accessible to workers during working hours.
4. The Contractor shall provide the necessary water for this project. The contractor may contact EBMUD to procure a hydrant meter. Contact Julie Sturgeon (510) 287-0357.
5. The Contractor shall not use residential or business water services for any purpose.

E. Temporary Sanitary Facilities:

1. Provide suitable and adequate sanitary facilities that are in compliance with applicable Laws and Regulations.
2. Fixed or potable chemical toilets shall be provided for the use of the Contractor's employees. These accommodations shall be maintained in a neat and sanitary condition. Toilets at construction sites shall conform to the requirements of Title 8, California Code of Regulations.
3. Wastewater conveyance and disposal shall not be interrupted. Should the Contractor disrupt existing sewer facilities, sewage shall be conveyed in closed conduits and disposed of in a sanitary sewer system. Sewage shall not be permitted to flow in trenches or be covered by backfill.
4. The Contractor shall establish a regular schedule for collection of all sanitary and organic waste. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the site in a manner satisfactory to the Inspector and in accordance with all laws and regulations pertaining thereto. Disposal of all such wastes shall be at the Contractor's expense.
5. At completion of the Work, remove sanitary facilities and leave site in neat and sanitary condition.

F. Temporary Fire Protection: Provide sufficient number of fire extinguishers of type and capacity required to protect the Work and ancillary facilities.

G. First Aid: Post first aid facilities and information posters conforming to requirements of OSHA and other applicable Laws and Regulations in readily accessible locations.

H. Utilities in Existing Facilities: See Section 01140- Work Restrictions

1.03 CONSTRUCTION AIDS

A. Provide railings, kick plates, enclosures, safety devices, and controls required by Law and Regulations and as required for adequate protection of life and property.

B. Use construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities or ample size and capacity to adequately support and move loads.

C. Design temporary supports with adequate safety factor to assure adequate load bearing capability.

1. When requested, submit design calculations by professional registered engineer prior to application of loads.

2. Submitted design calculations are for information and record purposes only.

D. Accident prevention:

1. Exercise precautions throughout construction for protection of persons and property.

2. Observe safety provisions of applicable Laws and Regulations

3. Guard machinery and equipment, and eliminate other hazards.

4. Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.

5. Before commencing construction Work, take necessary action to comply with provision for safety and accident prevention.

E. Barricades:

1. Place barriers at ends of excavations and along excavations to warn pedestrian and vehicular traffic of excavations.

2. Provide barriers with flashing lights after dark.

3. Keep barriers in place until excavations are entirely backfilled and compacted.

4. Barricade excavations to prevent persons from entering excavated areas in streets, roadways, parking lots, treatment plants, or other public or private areas.

F. Warning Devices and Barricades: Adequately identify and guard hazardous areas and conditions by visual warning devices and, where necessary, physical barriers.

1. Devices shall conform to minimum requirements of OSHA and State agency which administers OSHA regulations where Project is located.

G. Hazards in Public or Private Right-of-Way:

1. Mark at reasonable intervals, trenches, and other continuous excavations in public or private right-of-way, running parallel to general flow of traffic, with traffic cones, barricades, or other suitable visual markers during daylight hours.

a. During hours of darkness, provide markers with torches, flashers, or other adequate lights.

2. At intersections or for pits and similar excavations, where traffic may reasonably be expected to approach head on, protect excavations by continuous barricades.

    a. During hours of darkness, provide warning lights at close intervals.

H. Hazards in Protected Areas: Mark or guard excavations in areas from which public is excluded, in manner appropriate for hazard.

I. Protect existing structures, trees, shrubs, and other items to be preserved on Project site from injury, damage, or destruction by vehicles, equipment, worker or other agents with substantial barricades or other devices commensurate with hazards.

J. Fences:

1. Enclose site of the Work with fence adequate to protect the Work against acts of theft, violence, and vandalism.

2. Enclose temporary offices and storage areas with fence adequate to protect temporary facilities against acts of theft, violence, and vandalism.

3. When entire or part of site is to be permanently fenced, permanent fence may be built to serve for both permanent and temporary protection of the Work site, provided that damaged or defaced fencing is replaced prior to Substantial Completion.

4. Protect temporary and permanent openings and close openings in existing fences to prevent intrusion by unauthorized persons. Bear responsibility for protection of completed work and material when openings in existing fences are not closed.

5. During night hours, weekends, holidays, and other times when no work is performed at site, provide temporary closures or enlist services of security guards to protect temporary openings.

6. Fence temporary openings when openings are no longer necessary.

1.04 SECURITY

A. The Contractor shall make adequate provision for the protection of the Work area against fire, theft, and vandalism, and for the protection of the public against exposure to injury.

1.05 TEMPORARY CONTROLS

A. Dust Control:

1. Prevent dust nuisance caused by operations, excavation, backfilling, demolition, or other activities.

2. Control dust by sprinkling with water, use of dust palliatives, modification or operations, or other means acceptable to agencies having jurisdiction.

B. Noise Control:

1. Perform operations in manner to minimize noise and remain in conformance with City of Alameda ordinances.

2. Take special measures to suppress noise during night hours.

C. Mud Control:

1. Prevent mud nuisance caused by construction operations, excavation, backfilling, demolition, or other activities.

1.06 PROJECT SIGNS

A. Provide and maintain project identification sign, securely affixed as directed in the field, with clearly legible lettering equivalent to that of a professional sign painter using no more than 5 sign colors.

1. List at least the title of the Project, and names of the City, Design Engineer, and Contractor and approximate duration of construction.

2. List normal construction hours and provide a contact telephone number as directed by the City during the preconstruction conference.

1.07 OFFICES

A. Maintain on Project site weather-tight space in which to keep copies of Contract Documents, progress schedule, shop drawings, and other relevant documents.

B. The City will provide meeting space within Alameda containing a conference table and chairs for at least eight persons as required and requested.

1.08 REMOVAL

A. Remove temporary facilities before inspection for Substantial Completion or when directed.

B. Clean and repair damage caused by installation or use of temporary facilities.

C. Remove underground installations to minimum depth of 24 inches and grade to match surrounding conditions.

D. Restore existing facilities used during construction to specified or original condition.

1.09 MAINTENANCE OF STORM DRAIN PUMP STATIONS

A. Throughout the duration of pump station upgrades and testing, the Contractor shall maintain storm drain service at all times. Contractor is liable for any damage to property, cleanup costs, and regulatory fines associated with flooding that occurs due to pump station failure or inoperability during Construction.

B. Contractor shall expect minor inflow rates to the existing pump stations at all times during construction, including the dry season.

C. Contractor shall maintain full pump station capacity at all times if work is performed during the wet season (April 15th through October 15th) as detailed in Section 01140.

PART 2 PRODUCTS

2.01 TEMPORARY BYPASS PUMPS

A. Contractor shall provide temporary systems as necessary to convey the storm water inflows to each pump station at all times during construction. Temporary systems may include pumps, motors, level controls, alarms, all appurtenances, and power necessary to pump storm water as required during the course of construction and testing.

B. Temporary pumps shall be driven by electric motors except when the replacement of the primary transformer makes this impossible. The use of engines or engine-generators shall be kept to an absolute minimum.

C. Contractor may use the Owner's existing pumping equipment to meet this requirement. However, Owner does not warrant the condition of existing equipment.

D. See Section 1.09 above, Section 3.01 below and Section 01140 for additional requirements and restrictions.

2.02 FIRE EXTINGUISHERS

A. A sufficient number of fire extinguishers of the type and capacity required to protect the Work and ancillary facilities, shall be provided and maintained in readily accessible locations.

2.03 TEMPORARY SITE FENCES

A. Except as otherwise provided, the Contractor shall enclose the site of the Work with a fence adequate to protect the Work and temporary facilities against acts of theft, violence, or vandalism.

PART 3 EXECUTION

3.01 BYPASS PUMPING

A. The Contractor shall be responsible for conveying the storm water inflows to each pump station at all times during construction. This may require the use of temporary pumps and/or temporary control panels and temporary power.

B. In the event that the pump station operation is expected to be impacted during the Wet Season (October 15th through April 15th), the Contractor shall develop and submit a detailed written plan for conveying the storm water inflows at each pump station during construction. The plan shall be submitted to the City for

approval at least 14 days prior to commencing bypass of the flow. The plan shall include but may not be limited to; schematic showing all elements and location of proposed conveyance system, pump curves, bypass piping materials and location, pump control methods, pump power supply, duration of construction activity, temporary alarm and notification system, modification to existing alarm system, bypass monitoring plan, and detailed schedule for operation of bypass pumping.

C. At a minimum, the Contractor shall maintain high level and power failure alarms at all times during construction. The existing pump station alarm system can be used during construction if desired by the Contractor. Contractor shall coordinate with the City to have the alarm system notify the Contractor.

D. Above ground bypass piping is not allowed within the travel lanes of any roadway during non construction hours.

E. Temporary equipment shall remain in place until the new pump station equipment is fully functional and has passed all testing and startup requirements.

F. See Section 01140 for additional requirements and restrictions.

G. EMERGENCY RESPONSE

1. For the duration of construction, Contractor shall be available on a 24-hour on-call basis to respond to an emergency situation. The Contractor shall provide the City with a minimum of three (3) names of persons and their telephone numbers for this purpose. All persons listed shall be able to respond to any pump station emergency within 30 minutes of being notified.

3.02 CONSTRUCTION CLEANING

A. The Contractor shall, at all times, keep property on which work is in progress and the adjacent properties free from accumulations of waste material or rubbish caused by employees or by the Work. All surplus material shall be removed from the site immediately after completion of the work causing the surplus materials. Upon completion of the construction, the Contractor shall remove all temporary structures, rubbish, and waste materials resulting from its operations.

3.03 DISPOSAL OF MATERIAL

A. The Contractor shall make arrangements for disposing of materials outside the Site and the Contractor shall pay all costs involved. The Contractor shall first obtain permission from the property owner on whose property the disposal is to be made and absolve the Owner from any and all responsibility in connection with the disposal of material on said property. When material is disposed of as above provided, the Contractor shall conform to all required codes pertaining to grading, hauling, and filling of earth.

3.04 PARKING AND STORAGE AREAS

A. All stockpiled materials and parked equipment at the job site shall be located to avoid interference with private property and to prevent hazards to the public. Locations of stockpiles, parking areas, and equipment storage must be approved by the Owner's Representative.

END OF SECTION

SECTION 01610
SEISMIC DESIGN CRITERIA

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Seismic design criteria for the anchorage of equipment and other items as specified or indicated on the Contract Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01330 – Submittal Procedures

B. Section 05501 – Anchor Bolts

1.03 REFERENCES

A. 2013 California Building Code (CBC)

B. American Society of Civil Engineers (ASCE) 7-10 “Minimum Design Loads for Buildings and Other Structures”

1.04 SYSTEM DESCRIPTION

A. Design requirements: Design in accordance with the requirements of the 2016 CBC and ASCE 7-10 for equipment components.

1. Site Class: D
2. Risk Category: III
3. Mapped MCE_R Spectral Response Acceleration Parameter, S_S: To be determined for each specific pump station site.
4. Mapped MCE_R Spectral Response Acceleration Parameter, S_1: To be determined for each specific pump station site.
5. Component Amplification Factor, a_p: In accordance with ASCE 7-10, Table 13.6-1.
6. Component Response Modification Factor, R_p: In accordance with ASCE 7-10, Table 13.6-1.
7. Component Importance Factor, I_p: 1.50
8. Do not use friction to resist sliding due to seismic forces.
9. Do not use more than 60 percent of the weight of the equipment for designing anchors for resisting overturning due to seismic forces.
10. Use cast-in-place anchor bolts or post-installed anchors for resisting seismic forces.

a. Cast-in-place anchor bolts shall have a standard hex bolt head. Do not use anchor bolts fabricated from rod stock with an L or J shape. See Section 05501 – Anchor Bolts.

b. Post-installed anchors shall be either adhesive anchor bolts or expansion anchors. See Section 05501 – Anchor Bolts.

c. Seismic forces must be resisted by direct bearing on the fasteners used to resist seismic forces. Do not use connections which use friction to resist seismic forces.

1.05 SUBMITTALS

A. Shop Drawings and Calculations: Submit shop drawings and seismic calculations in accordance with Section 01330 – Submittal Procedures.

B. Equipment anchorage calculations as specified in Section 05501. Calculations shall be stamped and signed by a civil or structural Professional Engineer licensed to practice in the state of California.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01710
SITE MAINTENANCE AND CLEANUP

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included:

1. Throughout the construction period, maintain the site in a standard of cleanliness as described in this Section.

2. Tie-out and Underground Service Alert (USA) marking removal.

B. Related Work:

1. In addition to standards described in this Section comply with requirements for cleaning as described in Section 01500 “Temporary Facilities”.

1.02 QUALITY ASSURANCE

A. A daily inspection, and more often if necessary, shall be conducted by the Engineer to verify that requirements for cleanliness are being met.

B. In addition to the standards described in this Section, the Contractor shall comply with pertinent requirements of other governmental agencies having jurisdiction over this Work.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. The Contractor shall provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

PART 3 EXECUTION

3.01 SITE MAINTENANCE

A. General

1. Any stored items shall be placed in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.

2. The accumulation of scrap, debris, waste material and other items not required for construction of the Work shall not be allowed to occur.

B. Site

1. The Contractor shall inspect the site on a daily, and more often if necessary, basis and insure that all scrap, debris, and waste material is removed.

2. The Contractor shall maintain the site in a neat and orderly condition at all times. Both public and private areas shall be cleaned of all materials attributed to or involved in the Work on a daily basis. It is especially important to ensure that the site is left in a safe condition everyday, especially from loose lumber and nails.

C. Material that is stockpiled in the street shall be located no closer than ten feet from a catch basin and, during rainy weather, shall be covered with a waterproof covering. All loose material shall be swept up and removed from gutters at the end of each workday.

D. The Contractor shall collect and remove all saw cut slurry from the work area by the use of a wet vacuum or other method approved by the Engineer. The Contractor shall be responsible for the proper disposal of the collected slurry material.

E. The Contractor shall remove all utility, striping tie-out and USA paint markings upon completion of the work.

1. The method of tie-out and USA marking removal shall be approved by the Engineer prior to commencement of the work. Solvents may not be used.

3.02 FINAL CLEANING

A. The Contractor shall insure that all tools, surplus materials and soil, equipment, scrap, debris, and waste are removed from the project sites and storage area prior to the final inspection. Progress payments and / or retention payments may be held until work has been satisfactorily completed. Final cleaning constitutes part of the base contract.

B. Site:

1. Unless otherwise directed by the Engineer, clean all areas on the site with as specified herein.

2. Completely remove all debris and foreign matter.

C. Schedule final cleaning prior to final acceptance by City.

END OF SECTION

SECTION 01756
TESTING, TRAINING, AND FACILITY START-UP

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for equipment and system testing and facility start-up, including the following:

1. Start-up Plan.
2. Performance Testing.
3. General Start-up and Testing Procedures.
4. Functional Testing.
5. Operational Testing.
6. Certificate of Proper Installation.
7. Services of manufacturer's representatives.
8. Training of City's personnel.
9. Final testing requirements for the complete facility.

1.02 GENERAL TESTING, TRAINING, AND START-UP REQUIREMENTS

A. Contract Requirements: Testing, training, and start-up are requisite to the satisfactory completion of the Contract.

B. Complete testing, training, and start-up within the Contract Times.

C. Allow realistic durations in the schedule for testing, training, and start-up activities.

D. Furnish labor, power, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.

E. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation and testing guidance, and operator training.

1.03 START-UP PLAN

A. Submit start-up plan for each piece of equipment and each system not less than 2 weeks prior to planned initial start-up of equipment or system.

B. Provide a detailed startup schedule with the following activities identified:

1. Manufacturer's services.

2. Installation certifications.
3. Operator training.
4. Submission of Operation and Maintenance Manuals.
5. Functional testing.
6. Performance testing.
7. Operational testing.

C. Provide testing plan with test logs for each item of equipment and each system when specified. Include testing of alarms, control circuits, SCADA RTU status and alarms inputs, capacities, speeds, and other parameters.

D. Provide summary of shutdown requirements for existing systems which are necessary to complete start-up of new equipment and systems.

E. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

1.04 PERFORMANCE TESTING

A. Test equipment for proper performance at point of manufacture or assembly when specified.

B. When source quality control testing is specified:

1. Demonstrate equipment meets specified performance requirements.
2. Provide certified copies of test results.
3. Do not ship equipment until certified copies have received written acceptance from Engineer. Written acceptance does not constitute final acceptance.
4. Perform testing as specified in the equipment specification sections.

1.05 GENERAL START-UP AND TESTING PROCEDURES

A. Electrical Systems: As specified in the individual equipment specification sections.

1. Perform insulation resistance tests on wiring except 120 volt wiring, and control wiring inside electrical panels.
2. Perform continuity tests on grounding systems.
3. Test and set switchgear and circuit breaker for proper operation.
4. Check motors for actual full load amperage draw. Compare to nameplate value.

1.06 FUNCTIONAL TESTING

A. Perform checkout and performance testing as specified in the individual equipment specification sections.

B. Functionally test mechanical and electrical equipment, and instrumentation and controls systems for proper operation after general start-up and testing tasks have been completed.

C. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, SCADA RTU inputs, instrumentation and other equipment functions.

D. Conduct continuous 8 hour test under normal operating conditions. Replace parts which operate improperly.

1. If functional testing occurs during dry weather, the Contractor shall perform all tests to the extent feasible with minimal to no storm water inflows to the pump stations.

2. Additionally, **Contractor is responsible for monitoring, testing, and modifying/replacing equipment during the first five significant rainfall events following the initial functional test.**

a. A significant rainfall event shall constitute 0.5” of recorded rain within a 24 hour period as reported by the National Weather Service Forecast Service.

1.07 OPERATIONAL TESTING

A. After completion of operator training, conduct operational test of the entire facility. Demonstrate satisfactory operation of equipment and systems in actual operation as field conditions allow.

B. City will provide operations personnel; however, contractor shall provide power, fuel, and other consumables for duration of test.

C. Immediately correct defects in material, workmanship, or equipment which became evident during operational test.

D. Repeat operational test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

E. Operational monitoring and testing shall be confirmed by the Contractor during the first five significant rainfall events following the initial operational testing as defined in Section 1.06.D-2 above.

1.08 CERTIFICATE OF PROPER INSTALLATION

A. At completion of Functional Testing, furnish written report prepared and signed by manufacturer's authorized representative, certifying equipment:

1. Has been properly installed, adjusted, aligned, and lubricated.

2. Is free of any stresses imposed by connecting members or anchor bolts.

3. Is suitable for satisfactory full-time operation under full load conditions.

4. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.
5. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown have been tested and are properly functioning.
6. SCADA RTU inputs have been properly transmitted and received at the City's SCADA System Central Monitoring Station. This part of the report is also to be signed by the City's SCADA Consultant.

1.09 TRAINING OF CITY'S PERSONNEL

A. Manufacturers shall provide training for operations, maintenance and troubleshooting of all mechanical and electrical equipment and systems at each Pump Station.

B. Provide all necessary training materials in addition to operating manuals specified elsewhere.

C. Training shall be up to two 8 hour days for up to six people.

1.10 RECORD KEEPING

A. Maintain and submit following records generated during start-up and testing phase of Project:

1. Daily logs of equipment testing identifying all tests conducted and outcome.
2. Logs of time spent by manufacturer's representatives performing services on the job site.
3. Equipment lubrication records.
4. Electrical phase, voltage, and amperage measurements.
5. Insulation resistance measurements.
6. Records of testing and calibration of instrumentation devices and setpoints.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01782
OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Preparation and submittal of Operation and Maintenance Manuals.

1.02 SUBMITTALS

A. Submit Operation and Maintenance Manuals as part of the shop drawing approval process.

B. Make additions and revisions to the Manuals in accordance with Engineer's review comments.

C. Submit four (4) complete Manuals for each piece of equipment or system after shop drawing approval.

1.03 OPERATION AND MAINTENANCE MANUALS

A. Preparation:

1. Provide first submittal in electronic (PDF) format for review and approval prior to submitting final hard copies.
2. Provide 4 copies of approved Operations and Maintenance Manuals in 3-ring binders with rigid covers. Utilize tab sheets to organize information.
3. Provide electronic PDF copies of all final approved Operation and Maintenance Manuals.

B. Contents of Operation And Maintenance Manuals:

1. Cover Page: Equipment name, equipment tag number, project name, City's name, appropriate date.
2. Table of Contents: General description of information provided within each tab section.
3. Lubrication Information: Required lubricants and lubrication schedules.
4. Control Diagrams:
    a. Internal and connection wiring, wiring diagrams for control panels and connections between existing systems and new additions, and adjustments such as calibrations and set points for relays, and control or alarm contact settings.
5. Start-up Procedures: Recommendations for installation, adjustment, calibration, and troubleshooting.

6. Operating Procedures:
    a. Step-by-step procedures for starting, operating, and stopping equipment under specified modes of operation.
    b. Include safety precautions and emergency operating shutdown instructions.
7. Preventative Maintenance Procedures: Recommended steps and schedules for maintaining equipment.
8. Overhaul Instructions: Directions for disassembly, inspection, repair, and reassembly of the equipment; safety precautions; and recommended tolerances, critical bolt torques, and special tools that are required.
9. Parts List: Generic title and identification number of each component part of equipment; include bearing manufacturer, model and ball or roller pass frequencies for every bearing.
10. Spare Parts List: Recommended number of parts to be stored at the site and special storage precautions.
11. Drawings: Exploded view or plan and section views with detailed callouts.
12. Provide electrical and instrumentation schematic record drawings.
13. Provide approved shop and fabrication drawings.
14. Source (Factory) Quality Control Test Results: Provide copies of factory test reports.
15. Field Quality Control Test Results: After field testing is completed, insert field test reports.
16. Equipment Summary Form: Completed form in the format attached at the end of this Section. Insert Equipment Summary Form after the tab sheet of each equipment section. The manufacturer's standard form will not be acceptable.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM _____

2. MANUFACTURER _____

3. EQUIPMENT IDENTIFICATION NUMBER(S) _____
(maps equipment number)

4. LOCATION OF EQUIPMENT _____

5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) _____

_____

_____

_____

NAMEPLATE DATA -

Horsepower _____
Amperage _____
Voltage _____
Service Factor (S.F.) _____
Speed _____
ENC Type _____
Capacity _____
Other _____

7. MANUFACTURER'S LOCAL REPRESENTATIVE

Name _____

Address _____

Telephone Number _____

8. MAINTENANCE REQUIREMENTS _____

_____

_____

9. LUBRICANT LIST _____

_____

10. SPARE PARTS (recommendations) _____

_____

11. COMMENTS _____

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SECTION 02170
ASBESTOS REMOVAL AND DISPOSAL

PART 1 GENERAL

1.01 DESCRIPTION

A. The project requires cutting, removing, and disposing of existing steel pipe that is wrapped with asbestos. The Contractor shall remove and dispose of asbestos pipe wrap in accordance with State of California requirements, and the Contract Documents. Removal of asbestos pipe wrap shall be performed by a Contractor

B. The Contractor shall follow the AWWA guidelines for handling, removing and disposing of asbestos as stated in the applicable sections of AWWA Standards C400, C401, C402, and C403 covering Asbestos-Cement Transmission and Distribution Pipe.

C. Contractor shall follow all laws, regulations, and requirements for handling and disposing of asbestos.

1.02 EXISTING SITE CONDITIONS

A. Existing force mains to be removed have asbestos wrap as shown on the plans. The project requires cutting, removing, and disposing of asbestos pipe wrap.

1.03 SUBMITTALS

A. **Asbestos Removal and Disposal Plan:** The Contractor shall complete and submit an Asbestos Removal and Disposal Plan for review and approval prior to construction. The Contractor shall clearly describe his proposed methods for the removal and disposal of asbestos that ensures no exposure to airborne asbestos by the Contractor's personnel or by the public.

B. The Contractor shall submit documentation certifying that all asbestos was transported to, accepted, and properly disposed of, at a legal disposal facility.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall perform all cutting and handling of asbestos in accordance with State of California requirements. The Contractor shall provide sufficient supervision and perform monitoring to assure conformance with State

requirements. Under no circumstances shall the Contractor utilize methods of removal that result in the release of asbestos fibers into the air.

3.02 REMOVAL

A. All personnel handling asbestos shall wear properly fitted respirators during the removal and bagging operation, and shall be trained in the use of the respirator equipment. All pedestrian traffic shall be rerouted to maintain 30 feet clear of the asbestos work area.

B. All removed asbestos shall be bagged and prepared for disposal immediately after removal as described below.

3.03 DISPOSAL

A. The Contractor shall transport and dispose of all asbestos in accordance with State requirements at a legally operating landfill that accepts asbestos. All asbestos shall be wetted and double wrapped or bagged with polyethylene wrap immediately after removal. The minimum thickness of polyethylene wrap shall be 6 mils. The outer wrap shall be securely held in place with tape in a manner to prevent the release of airborne asbestos fibers.

B. The Contractor shall submit documentation certifying that all asbestos was transported to, accepted, and properly disposed of, at a legal disposal facility.

END OF SECTION

SECTION 02200
SITE PREPARATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Clearing and preparing project site for work activities.

B. Related Sections:

1. Section 01145 - Contractor's Use of the Premises.
2. Section 01354 - Hazardous Materials Procedures.
3. Section 01500 - Temporary Facilities and Controls.

1.02 DEFINITIONS

A. Clearing: Consists of removal of natural obstructions and existing foundations, buildings, fences, lumber, walls, rubbish, pavement, landscaping, and any other items which shall interfere with construction operations or are designated for removal.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Verify and comply with applicable regulations governing noise, dust, nuisance, drainage and runoff, fire protection, and disposal.

B. Pre-construction Conference: Discuss order and method of work.

1.04 PROJECT CONDITIONS

A. Environmental Requirements:

1. For suspected hazardous materials found, comply with Section 01354 - Hazardous Materials Procedures.

B. Existing Conditions:

1. Verify character and amount of material and rubbish involved and work to be performed.

C. The Contractor shall adhere to appropriate methods recommended by the Bay Area Air Quality Management District to minimize airborne pollution, including but not limited to frequent watering of open trenches, covering of excavated dirt and related actions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine site and verify existing conditions for beginning work.

3.02 PREPARATION

A. Protect existing improvements from damage by site preparation work. Install fence at drip line of trees to remain as necessary to prevent damage from operations.

3.03 INSTALLATION

A. Clearing:

1. Clear areas where construction is to be performed and other areas as indicated on the Drawings or specified in this Section of pavement, fences, lumber, walls, concrete, rubbish, and other objectionable material of any kind which, if left in place, would interfere with proper performance or completion of the work, would impair its subsequent use, or form obstructions therein.
2. Do not incorporate material from clearing operations in fills and backfills.
3. Contractor's Temporary Construction Facilities: Fill or remove pits, fill, and other earthwork required for erection of facilities, upon completion of the work, and level to meet existing contours of adjacent ground.

3.04 PRESERVATION OF PROPERTY

A. The project area shall be cleared **only** to the extent necessary to accommodate the work in conformance with the notes and details shown on the plans. Trees or growth shall not be trimmed back unnecessarily.

B. Contractor shall take extreme care not to damage shrubs, trees, fences, irrigation systems, and other improvements of adjacent property owners.

C. All existing improvements not specifically designated on the plans to be removed or relocated shall remain in their original condition and location undisturbed. However, upon written permission by the Engineer, existing improvements may, for the convenience of the Contractor, and at his expense, be removed and temporarily relocated during construction and shall be replaced in their original location in as good or better condition as when the Contractor entered upon the work site

3.05 DEMOLITION OF SURFACE IMPROVEMENTS

A. Removal of sidewalks, curbs and gutters, driveways, concrete slabs and pavement if necessary shall be in accordance with the provisions of Section 15-3 of the State Standard Specifications. Curbs, gutters, sidewalks, driveways,

slabs and pavement shall be removed by full depth saw cut to the nearest joint from the lines shown on the plans or as directed by the Engineer.

B. Where the plans indicate construction under existing asphalt pavement or the replacement of existing asphalt pavement, the existing pavement shall be removed and disposed of off-site.

3.06 REMOVAL OF DEBRIS

A. All demolished and cleared material and equipment shall become the property of the Contractor and shall be legally disposed of by the Contractor.

B. Demolished concrete shall not be buried in structure backfill areas.

END OF SECTION

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SECTION 02222
SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Demolition of buildings and appurtenant structures.

B. Related Sections:

1. Section 01140 - Work Restrictions.
2. Section 01710 - Site Maintenance and Cleanup.
3. Section 03300 – Reinforced Concrete.

1.02 SUBMITTALS

A. Demolition plan and schedule.

B. Disposal means and locations.

1.03 PROJECT CONDITIONS

A. Environmental Requirements:

1. Conform to existing environmental requirements and regulations regarding noise, dust, and vibration.

B. Existing Conditions:

1. Verify that utility services are disconnected.

1.04 SEQUENCING AND SCHEDULING

A. Sequencing

1. See Section 01140 for sequencing and scheduling requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions pertaining to demolition work.

3.02 PREPARATION

A. Utilities:

1. Disconnect any remaining utility services that will no longer be active, or will not be used during construction to maintain an operating facility.
2. Remove all disconnected utilities within the site.
3. Repair utility mains as necessary in conformance with City of Alameda Standard Specifications and Details.

B. Protection:

1. Use saw cutting and other methods acceptable to Engineer to protect adjacent facilities.
2. Provide berms and other means acceptable to Engineer to keep drainage from demolition areas.

3.03 DEMOLITION

A. Completely remove from project site structures specified or indicated on the Drawings to be demolished.

B. Unless otherwise specified or indicated on the Drawings, demolition includes removal of slabs, footings, foundations, conduits, and appurtenances and backfilling of any resulting voids in the subgrade with suitable excavated or imported material, compacted to 95 percent relative density.

C. The City maintains the right of refusal to retain any and all materials and equipment identified to be removed from the site. The contractor shall coordinate with the City prior to demolition to identify the items that the City would like to retain. The Contractor shall remove the items to be retained from the pump station, set them aside, and notify the City. The City will pick up the items up from the site.

D. Demolition debris shall be handled in conformance with Section 01710, “Site Maintenance, and Cleanup.”

END OF SECTION

SECTION 02260
EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for designing, furnishing and installing, maintaining, and removing excavation support and protection.

B. Related Sections:

1. Section 02318 - Trenching.
2. Section 02300 – Earthwork.

1.02 REFERENCES

A. American Institute of Steel Construction, Inc. (AISC):

1. Manual of Steel Construction Allowable Stress Design.

B. American Society of Civil Engineers:

1. Guidelines of Engineering Practice for Braced and Tied-Back Excavations.

C. California Code of Regulations (CCR):

1. Title 8 - Construction Safety Orders.

D. California Labor Code Sections 6705 to 6707 (CLC).

E. Department of the Navy Naval Facilities Engineering Command (NAVFAC):

1. NAVFAC Design Manual 7.2 - Foundations and Earth Structures.
2. NAVFAC Design Manual 7.3 - Soil Dynamics Deep Stabilization and Special Geotechnical Construction.

F. International Code Council (ICC):

1. California Building Code (CBC).

G. State of California Department of Transportation (Caltrans):

1. Caltrans California Trenching and Shoring Manual.

H. United States Steel Corporation (USS):

1. USS Steel Sheet Piling Design Manual.

1.03 DEFINITIONS

A. General Engineering Design Practice: General engineering design practice in area of the Project, performed in accordance with recent engineering literature on subject of shoring and stability of excavations.

B. Shoring: A temporary structural system designed to support vertical faces, or nearly vertical faces, of soil or rock for purposes of excavation. Shoring includes internally braced sheet piling, slurry walls, soldier piles and lagging, and other similar shoring systems. Sloping of the soil is not shoring.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. CONTRACTOR assumes full and complete responsibility for excavation support and protection, including shoring design and installation.

B. The review of CONTRACTOR's shoring system design, submittals and/or installations by the ENGINEER does not relieve CONTRACTOR of his responsibility for excavation safety. This requirement shall apply continuously and is not limited to normal working hours.

C. CONTRACTOR's reliance upon documents furnished by City does not provide relief from these requirements.

1.05 SYSTEM DESCRIPTION

A. **Contractor shall note the presence of bay mud material and shallow groundwater as discussed and identified in the project geotechnical report.**

1. **3rd Street Pump Station: In order to effectively shore the excavations and protect the adjacent infrastructure and utilities, slide rail shoring systems and/or interlocking sheet piles may be required.** The shoring systems shall be installed such that the intrusion of groundwater is kept to an absolute minimum.

B. Acceptable means for shoring the wetwell excavation for the 3rd Street Pump Station shall include one of the following methods. **No other shoring methods will be acceptable for the wetwell excavation**. The shoring systems shall be installed such that the intrusion of groundwater is kept to an absolute minimum.

1. Interlocking sheet piles
2. Drilling and installation of a large diameter casing.
3. Slide-rail shoring system with methods for minimizing water intrusion into excavation.

C. **Shoring drawings and calculations for all shoring systems for excavations deeper than 5 feet shall be prepared and signed by a civil or structural engineer registered in California.**

1. Provide design calculations that clearly disclose assumptions made, criteria followed, and stress values used for the materials being used.
2. Furnish references acceptable to ENGINEER substantiating appropriateness of design assumptions, criteria, and stress values.

D. Design Loads:

1. Contractor shall design all shoring elements using the soil unit weights and parameters identified in the Geotechnical Evaluation Report included as an attachment to these specifications.

E. Design Requirements:

1. General:
    a. Design means for safe and stable excavations in accordance with general engineering design practice.
        1) The preceding requirement shall not apply to trench excavation support conforming to standards set forth in CCR Title 8 - Construction Safety Orders.
    b. Design steel members in accordance with the California Building Code and the AISC Manual of Steel Design.
    c. Design shoring involving materials other than steel in accordance with California Building Code.
    d. When electing to design with material stresses for temporary construction higher than allowable stresses prescribed in the Manual of Steel Construction and the California Building Code, increase in such stresses shall not exceed 10 percent of value of prescribed stresses.
    e. Minimum safety factor used for design shall not be less than 1.3.
    f. The calculated minimum depth of penetration of shoring below the bottom of the excavation shall be increased not less than 30 percent if the full value of passive pressure is used in the design.
    g. The maximum height of cantilever shoring above the bottom of excavation shall not exceed 15 feet. Use braced shoring when the height of shoring above the bottom of excavation exceeds 15 feet.
    h. The location of the point of fixity for shoring shall not be less than half the calculated minimum embedment depth below the bottom of the excavation.
    i. Generally acceptable references for the design of shoring and excavations are as follows:
        1) Caltrans California Trenching and Shoring Manual.
        2) NAVFAC Design Manual 7.2 - Foundations and Earth Design.
        3) NAVFAC Design Manual 7.3 - Soil Dynamics Deep Stabilization and Special Geotechnical Construction.

4) USS Steel Sheet Piling Design Manual.

5) Guidelines of Engineering Practice for Braced and Tied-Back Excavations published by American Society of Civil Engineers.

j. Shoring design shall be performed by a Civil or Structural Engineer licensed to practice in California. Include costs for this shoring design in the bid.

2. Soldier Piles and Lagging:

a. Soldier pile and lagging systems shall not be used in areas where bay mud soils are present.

b. Provide lagging over the full face of the excavation. Joints between pieces of lagging shall be tight to prevent loss of soil.

c. Provide full face lagging all around penetrations through the lagging.

d. If the soldier piles are installed in predrilled holes, the predrilled holes shall be filled with control density backfill after the soldiers piles are installed.

e. The effective width of driven soldier piles for passive soil resistance shall not exceed 2 times the width of the pile. The effective width of concrete encased soldier piles for passive soil resistance shall not exceed 2 times the width of the concrete encasement.

f. Fill voids behind lagging with gravel or other material acceptable to the ENGINEER.

g. Apply loads from tie back soil, rock, or deadman anchors concentrically to soldier piles or wales spanning between soldier piles. Wales shall be back-to-back double channels or other members acceptable to the ENGINEER. Eccentrically loaded with section soldier piles or wales are not acceptable.

h. Tie backs shall not be used in bay mud soils.

3. Soil Anchors, Rock Anchors, and Deadmen Anchors:

a. Design tie back anchors for a safety factor of not less than 2 times the calculated load from the shoring.

b. Proof load all production anchors to not less than 125 percent of the calculated load from the shoring. Lock off anchors at the calculated anchor load.

c. The length of soil anchors used to calculate resistance to load from the shoring, shall not include any length within the potential active pressure soil failure zone behind the face of shoring.

d. Apply load from anchors concentrically to wales and other shoring members.

e. Design tie rods for anchors for 130 percent of the calculated load from the shoring.

f. Design tie rods for anchors for 150 percent of the calculated load from the shoring when tie rod couplers are used and for other conditions where stress concentrations can develop.

F. Performance Requirements:

1. General:

a. Support faces of excavations and protect structures and improvements in vicinity of excavations from damage and loss of function due to settlement or movement of soils, alterations in ground water level caused by such excavations, vibration associated with installation and removal of excavation support structures, and related operations.

b. Herein Specified Provisions:

1) Complement, but do not substitute or diminish, obligations of CONTRACTOR for the furnishing of a safe place of work pursuant to provisions of the Occupational Safety and Health Act of 1970 and its subsequent amendments and regulations and for protection of the Work, structures, and other improvements.

2) Represent minimum requirement for:

a) Number and types of means needed to maintain soil stability.

b) Strength of such required means.

c) Methods and frequency of maintenance and observation of means used for maintaining soil stability.

2. Provide safe and stable excavations by means of sheeting, shoring, bracing, sloping, and other means and procedures, such as draining and recharging groundwater and routing and disposing of surface runoff, required to maintain the stability of soils and rock.

3. Provide support for trench excavations for protection of workers from hazard of caving ground.

4. Provide Shoring:

a. Where, as result of excavation work and analysis performed pursuant to general engineering design practice, as defined in this Section:

1) Excavated face or surrounding soil mass may be subject to slides, caving, or other types of failures.

2) Stability and integrity of structures and other improvements may be compromised by settlement or movement of soils, or changes in soil load on structures and other improvements.

b. For trenches 3 feet and deeper.

c. For trenches less than 3 feet in depth, when there is a potential for cave-in.

d. Where indicated on the Drawings.

5. For safe and stable excavations, use appropriate design and procedures for construction and maintenance to minimize settlement of supported ground and to prevent damage to structures and other improvements, including:
    a. Using stiff support systems.
    b. Following appropriate construction sequence.
    c. Preventing soil loss through or under support system.
        1) Provide support system that is tight enough to prevent loss of soil and extend deep enough to prevent heave or flow of soils from supported soil mass into the excavation.
    d. Providing surface runoff routing and discharge away from excavations.
    e. Where dewatering is necessary, recharge groundwater as necessary to prevent settlement in area surrounding excavation.
    f. Where sheet piling is used, use interlocking type sheets including interlocking corners. The sheet piles shall be continuous and driven in interlock. If the bottom of the excavation is located below the water table, use "thumb and finger" type interlock.
    g. Not applying shoring loads to existing structures and other improvements.
    h. Not changing existing soil loading on existing structures and other improvements.
    i. Provide welded steel packing between soil retaining members such as sheet piles and wales and similar members when the gap exceeds 1/2 inch before the wales are loaded.
6. Do not use cantilever sheet pile shoring. When sheet piling is used, provide a braced system with a minimum of 2 levels of wales and braces. Locate top level of wales and bracing within 5 feet of the top of the sheets.
7. Use template for driving sheet piles to minimize need for pulling and redriving sheet piles in the attempt to drive them plumb in areas where bay mud is present.

1.06 SUBMITTALS

A. Shop Drawings and Calculations:
    1. In accordance with requirements in California Labor Code for trench excavations 5 feet or more in depth and for trenches less than 5 feet in depth when there is potential for cave-in. Submit in advance of excavation work, detailed drawings showing means for safe and stable excavations.
        a. Where such drawings vary from excavation support standards set forth in California Code of Regulations Title 8 - Construction Safety Orders, submit design calculations pursuant to general engineering design practice.

b. Provide means for safe and stable excavations that are not less effective than required in CCR Title 8 - Construction Safety Orders.

2. For excavations other than trenches, submit, in advance of excavation work, design calculations as performed pursuant to general engineering design practice, as specified in this Section, and detail drawing showing means for safe and stable excavations. In design calculations and detail drawing, cover, as a minimum:

   a. Excavations adjacent to structures and other improvements, and

   b. Excavations 5 feet or more in depth, or less than 5 feet in depth when there is potential for cave-in, at other locations.

3. Submit Following:

   a. Provide calculations for the different load, support, and other conditions that occur during the sequence of installation of shoring, construction of facilities protected by the shoring, and sequence of removal of shoring.

   b. Provide sketches showing the condition at various stages of installation and removal of shoring.

   c. Show structures, pipelines, and other improvements located near the shoring, and the shoring on a plan.

   d. When utilities penetrate the shoring, submit an elevation of all sides of the shoring showing the locations of the penetrations. Submit details on ground support and sealing around utility penetrations.

B. Control Points and Schedule of Measurements:

1. Control points shall be established and monitored for all activities that affect the groundwater level (dewatering wells or other) or that create significant ground movement or vibrations as specified in Section 01500-3.02.

2. Contractor shall establish control points on shoring systems to monitor movement during construction.

3. Submit location and details of control points and method and schedule of measurements in accordance with requirements of this Section.

4. Promptly upon constructing control points and making measurements at such control points, as specified in this Section, submit copy of field notes with such measurements. The field notes shall show the current measurement and the change in measurement from the first measurement taken.

C. Detailed Sequence of Installation and Removal of Shoring:

1. Consider effects of ground settlement in the sequence of installation and removal of shoring.

2. Provide sketches showing the conditions at various stages in the sequence of installation and removal of shoring.

3. Contractor shall consider leaving sheet piles and/or excavation casings in place after construction to minimize ground movement and settlement.

4. Removal of sheet piles is only acceptable if it can be done in a manner that does not produce excessive ground movement and vibrations. If sheet pile removal causes excessive vibration the Contractor will be required to alter the sheet pile removal methods or abandon the sheet piles in place at no additional cost to the City.

5. Clay and silt may stick to sheet piles when sheet piles are removed.

D. Submit submittals for stability of excavations as a complete package and include all items required in this section. Incomplete submittals will not be reviewed and will be returned for resubmittal as a complete package. Complete submittal shall include all necessary information regarding the dewatering system as specified in Section 02300.

1.07 SEQUENCING AND SCHEDULING

A. Do not begin work on excavations, trenches, and means for providing stability of excavation and trenches until submittals have been accepted by ENGINEER and until materials necessary for installation are on site.

B. Submit submittals a minimum of 30 days prior to the scheduled date to begin excavation work.

C. Do not begin construction of any shoring or excavation operations until:

1. Control points as specified in this Section and as indicated on the Drawings on existing structures and other improvements have been established and surveyed to document initial elevations and locations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 INSTALLATION AND REMOVAL

A. Install means for providing safe and stable excavations as indicated in the submittals section above.

B. Except for concrete encased soldier piles, slurry walls, sheet piles, and similar shoring systems, remove shoring by completion of the Work. Select shoring system and method of removal, which will minimize soil that sticks to shoring from creating large voids and causing settlement. To prevent settlement caused by pulling shoring, fill voids with sand, pea gravel, or pressure injected grout. The methods used shall prevent settlement.

C. Contractor shall consider Contractor shall consider leaving sheet piles and/or excavation casings in place after construction to minimize ground movement and settlement.

3.02 MAINTENANCE

A. Where loss of soil occurs, plug gap in shoring and replace lost soil with fill material acceptable to ENGINEER.

B. Where measurements and observations indicate possibility of failure or excessive movement of excavation support, determined in accordance with general engineering design practice, take appropriate action immediately.

END OF SECTION

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SECTION 02300
EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. The general extent of all excavation, fill and grading is shown on the Plans.

B. Section Includes:

1. Removal of excess and unsuitable material from the sites.
2. Excavation of material to allow for the placement of structures and foundations, including any necessary shoring and bracing.
3. Backfilling of underground conduit, pipe, and structures.
4. Preparation of subgrade for concrete slab work and pavement.
5. Furnish and compact fill.
6. Finish grading.

C. Related Sections:

1. Section 01140 – Work Restrictions.
2. Section 02260 – Excavation Support and Protection.
3. Section 02318 - Trenching.
4. Section 02722 - Aggregate Base Course.
5. Section 03300 - Reinforced Concrete.

1.02 REFERENCES

A. Associated General Contractors (AGC):

1. Manual of Accident Prevention in Construction (Section 9).

B. American Society for Testing and Materials (ASTM):

1. C 131 - Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
2. C 136 - Test Method for Sieve Analysis of Fine and Course Aggregates.
3. D 422 - Standard Test Method for Particle - Size Analysis of Soils.
4. D 1556 - Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
5. D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m).

6. D 2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
7. D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
8. D 3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
9. D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

C. Division of Industrial Safety (DIS).

D. Institute of Makers of Explosives (IOMOE).

E. Occupational Safety and Health Act (OSHA).

F. State of California Department of Transportation (Caltrans).

1.03 DEFINITIONS

A. Excavation: Consists of satisfactory loosening, removing, loading, transporting, depositing, and compacting in final location, wet and dry materials, necessary to be removed for purposes of construction, or as required for ditches, grading, roads, and such other purposes as are indicated on the Plans.

B. Backfill Adjacent to Structure: Is backfill around the exterior surfaces of a structure from the bottom of the excavation to finish grade.

C. In-Place Density of Compacted Backfill: Is density determined in accordance with ASTM D 1556, or with ASTM D 2922 and ASTM D 3017.

D. Maximum Density: Is maximum density obtained in laboratory when tested in accordance with ASTM D 1557 and ASTM D4253 for levee toe drain aggregate.

E. Definitions Related to Compaction of Coarse Fill:

1. One Pass: Defined as one movement of roller over area being compacted.
2. Measurement Of Pass Width: Measure width of pass between centers of outside tires or outside edge of roller wheel.

F. Optimum Moisture Content: Is the optimum content at the maximum density when tested in accordance with ASTM D 1557.

1.04 SYSTEM DESCRIPTION

A. Performance Requirements:

1. General:

a. Obtain acceptable material from other sources if surplus or borrow materials obtained within project sites do not conform to specified requirements or are not sufficient in quantity for structural backfill.

b. No extra compensation will be made for hauling fill materials or for water required to compact fills.

2. Subgrade Preparation:

a. Where mud or other soft or unstable material is encountered, remove such material to a minimum of 12 inches. The bottom of the over-excavation should then be completely covered with geotextile and backfilled with crushed rock. The stabilization fabric (Mirafi 140N or approved equal) should be wrapped around the backfill up to the bottom of the excavation.

3. Structural Backfill:

a. Material for Backfill: As specified in these specifications

4. Compacted Fills:

a. Provide specified compaction for backfill, fill, and other earthwork.

b. The City will perform confirmation tests to verify and confirm that work has complied, and is complying at all times, with requirements specified in this Section concerning field quality control testing.

5. Borrow Area:

a. Where borrow material is required, provide such material from source selected by the Contractor, subject to acceptance by the Engineer, but not necessarily from within project sites.

b. Use of imported borrow shall not cause additional cost to the Contract.

B. Environmental Requirements:

1. Keep excavations reasonably free from water.

2. Provide standby power to ensure continuous dewatering in case of power failure.

1.05 SUBMITTALS

A. Product Data: Submit material source, gradation, and testing data for all materials, including imported and on-site materials.

B. Test Reports: Submit certified test reports of all tests specified to be performed by the Contractor. Test reports shall be signed and sealed by a registered geotechnical engineer in the state of California.

C. Excavation Plan: Submit proposed excavation plan which shall include a detailed description of materials and equipment to be used, limits of excavation, material stockpile locations, and a shoring plan.

D. Dewatering Plan: Proposed dewatering plan including arrangement, location, and depths of system components, type, and sizes of filters, water sample, and required permits.

1.06 QUALITY ASSURANCE

1. Compaction Sequence Requirements: Until specified degree of compaction on previously specified amounts of earthwork is achieved, do not perform additional earthwork of the same kind.
2. After satisfactory conclusion of initial compaction demonstration and at any time during construction, provide confirmation tests as directed by the Engineer.
3. Dewatering: Dispose of water from dewatering in accordance with Section 3.09.
4. Testing and Inspection

   Contractor:

   a. The Contractor will cooperate with and notify Owner's agent at least 48 hours in advance of inspections required.

   b. Should the materials at the site proposed by the Contractor fail to meet the specified requirements, the Contractor must propose another site to provide required material and pay for any subsequent inspections and testing necessary to verify compliance of proposed materials to those specified.

   c. At least 60 days before any backfill work is to be done, the Contractor must clear the site proposed to provide imported borrow, structure backfill, or pervious backfill and allow the Owner's agent to take samples as required to test materials for conformance to these specifications.

1.07 SEQUENCING AND SCHEDULING

A. Schedule earthwork operations to meet requirements as provided in this Section for excavation and uses of excavated material.

B. Excavation and Filling: Perform excavation and filling, during construction, in manner and sequence that provides drainage at all times.

PART 2 PRODUCTS

2.01 MATERIALS

A. Water for Compacting Fills: Use water from source acceptable to Engineer.

B. Fill Materials:

1. General:

   a. Provide aggregate base course, select material, bedding, engineered fill and native material, where required for fill and backfill.

   b. Obtain material for fills from cut sections or from borrow sources.

c. Provide material having maximum particle size not exceeding 1 inch and that is free of trash, lumber, debris, leaves, grass, roots, stumps, and other vegetable matter.

d. Fill materials provided shall be free of environmental contaminates.

e. Materials derived from processing demolished or removed asphalt concrete are not acceptable.

f. Proposed imported fill shall be approved by the Engineer at least five working days prior to site delivery. Compliance testing for aggregate base may require up to ten days.

2. Crushed Rock: Crushed rock for mat foundation underlayment, pipe bedding, and where necessary to stabilize excavation bottom shall be a clean, durable, open graded rock meeting the requirements of ASTM No. 57 Stone with the following gradation:

Sieve Size	Percent Passing
1 1/2-inch	100
1-inch	95-100
1/2-inch	25-60
No. 4	0-10
No. 8	0-5

3. Pipe Bedding and Pipe Zone Material:

a. As shown on the plans and specified herein, the pipe bedding and pipe zone material shall be drain rock (3/4" crushed rock). Drain rock shall consist of clean, durable, crushed, uniformly graded angular drain rock conforming to Caltrans Standard Specifications. It shall be composed of hard durable, sound pieces free from slaking or decomposition under action of alternate wetting and drying.

b. Drain rock shall conform to the following requirements:

4.

Property		Test Procedure
Sieve Size	**Percent Passing**	
3/4-inch	100	ASTM D422
No. 200	Less than 3	ASTM D422
Durability Index:		
40 minimum		CTM D229
Percent Crushed Particles:		
95% minimum		CTM 205

5. Aggregate Base Course: As specified in Section 02722.
6. Controlled Density Fill (CDF): CDF shall be self compacting upon backfilling placement and shall be composed of cementitious materials, aggregates, water, and an air-entraining admixture, as follows:
    a. Cementitious materials shall be Portland cement in combination with fly ash.
    b. Admixture shall be an air-entraining agent.
    c. CDF admixture shall contain no aggregate larger than 3/8 inch. Amount passing a No. 200 sieve shall not exceed 12 percent. No plastic fines shall be present.
    d. Total calculated air content shall not exceed 30 percent, as tested in accordance with ASTM C231.
    e. CDF shall have an unconfined compressive strength at 28 days from a minimum of 50 psi to a maximum of 150 psi.
7. General Fill:
    a. Material for general site filling should be obtained from suitable native or import material as described herein.
    b. Trench backfill above the pipe zone shall be general fill.
8. Native Material:
    a. Sound, earthen material passing 1 inch sieve.
    b. Free from sod, large lumps, boulders, rocks, roots, brush, or other objectionable material, and free of hazardous materials as defined by Section 25117 of the State Health and Safety Code.
    c. Percent of material by weight passing Number 200 sieve shall not exceed 30 when tested in accordance with ASTM C 136.
    d. Expansion index less than 35.
    e. The use of Bay Mud as a fill material is unacceptable.
9. Lightweight Backfill:
    a. Lightweight backfill shall conform to ASTM C330 Standard Specifications for lightweight Aggregates for Structural Concrete.
    b. Lightweight backfill shall meet the following gradation:

Sieve Size	Percent Passing
1-inch	100
3/4-inch	80-100
3/8-inch	10-50
No. 4	0-15
No. 100	0-5

c. The dry loose unit weight of lightweight backfill shall be less than 75 pcf. The compacted in-place density shall be less than 80 pcf as measured in accordance with ASTM D-698.

d. Lightweight backfill shall be placed in layers not to exceed 12-inches, measured prior to compaction.

e. Each layer shall be compacted using a vibratory compactor.

f. Lightweight aggregate shall have a proven record of durability and be non-corrosive.

10. Sand Bedding:

a. As shown on the plans and specified herein, bedding material for conduits and irrigation lines shall be clean and graded, washed sand, all passing No. 4 U.S. Standard sieve, and conforming generally to ASTM C33 for fine aggregate. Finer sand may be used (quarry fines), if convenient, provided the sand is clean and does not contain deleterious substances in excess of the amounts specified in ASTM C33, Table 3.

11. Imported Materials:

a. Imported materials shall be in conformance with Section 19 of the State Standard Specifications, these Special Provisions for their intended use, and approved by the Engineer prior to use. The Contractor shall submit for review information on all backfill materials to be used on the project giving a description of the source of the material, environmental history, and past uses of the property at the source location, quantity of material and the purpose for which it is intended.

b. Import material shall have a plasticity index of less than 15 and a liquid limit of less than 40 as tested in accordance with ASTM D4318.

c. Import material shall have a sand equivalent greater than 10 as tested in accordance with California Test 217.

d. Imported materials shall conform to the following gradation as tested in accordance with ASTM D422:

Sieve	Percentage of Dry Material Passing by Weight
3”	100
3/4”	80 - 100
No. 4	40 – 70
No. 40	20 – 50
No. 200	Greater than 15

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Character and Quantity of Material:

a. Verify character and quantity of rock, gravel, sand, silt, water, and other inorganic or organic materials to be encountered in work to be performed.

b. Determine gradation and shrinkage of excavation and fill material, and suitability of material for use intended in work to be performed.

c. Determine quantity of material, and cost thereof, required for construction of excavations and fills, whether from on-site excavations, borrow areas, or imported materials. Include in cost of work to be performed.

d. Include wasting of excess material, if required, in cost of work to be performed.

e. All excavated soils will need to be segregated, cleaned, and/or screened prior to re-use (Native Material).

f. The Contractor shall, prior to submitting his bid, visit the sites and become familiar with actual site and soil conditions. No allowance will be made by the City for any unfavorable conditions or events which should have been foreseen from a thorough examination of the contract documents, the sites, and working conditions.

B. Verification of Prepared Subgrade prior to Constructing Improvements:

1. The Contractor shall request the Engineer to visually inspect and provide written confirmation of the suitability of prepared subgrade soils prior to the continuation of work.

a. Work completed without such confirmation is at the Contractor’s risk and subject to removal at the direction of the Engineer.

b. The Engineer will perform this inspection no later than two working days after the Contractor makes his request.

2. Contractor shall protect excavation prior to and during the inspection.

a. The Contractor remains solely responsible for excavation safety. This responsibility is not waived when the Engineer agrees to enter the work sites for inspection.

3.02 PROTECTION

A. If existing live utilities are encountered, they are to be protected from damage and the proper authorities and affected utility companies notified. All contractors must call 1(800) 227-2600, 48 hours before digging. Excavation for underground facilities must not be permitted prior to underground service alert's identification of existing utilities.

B. Record unmarked utility locations on record drawings and notify the Engineer.

C. Notify utility company to remove and relocate utilities.

D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Open excavations, trenches, and the like are to be protected with fences, barricades, covers, and railings as required.

F. Every precaution shall be taken to prevent spillage when hauling on or adjacent to any public street or highway. Any spillage shall be promptly removed.

G. Adjoining public and private property must be protected from damage during construction, remodeling and demolition work. Provide written notice to the owners of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings will be protected. Notification must be delivered not less than 10 days prior to the scheduled starting date of the excavation.

3.03 SAFETY

A. The Contractor is solely responsible for excavation safety, including support to all adjacent improvements at all times.

3.04 PREPARATION

A. Surface Preparation:

1. Preparing Ground Surfaces for Fill or Concrete:

a. After clearing, grubbing and stripping is completed, scarify entire areas which underlie fill sections or structures to a depth of 6 inches and until surface is free of ruts, hummocks, and other features which would prevent uniform compaction by equipment to be used.

b. Moisture condition and recompact areas to density specified in "Compacted Fills" before placing of fill material or concrete.

c. Where cemented rock, cobbles, or boulders compose a large portion of foundation material underlying structures, slabs, or paved areas, it may not be advisable to scarify the top 6 inches prior to compaction. If the ENGINEER deems it advisable not to scarify existing natural ground, then moisten the native soil and compact it as specified in "Compaction of Coarse Fill."

d. Where subgrade stabilization is required, scarification and compaction of native soils is not practical. In these instances stabilize the subgrade by placing geotextile and crushed rock as shown on the plans and/or specified herein.

e. Finished compacted subgrade shall be firm and non-yielding under the weight of compaction equipment. If the relative compaction of the subgrade is less than specified, or the surface of the subgrade exhibits significant yielding, over-excavate the area and rebuild or rework the

area until the subgrade compaction conforms to this specification.

f. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

2. Preparing for Backfill:

a. After completion of foundation footings and walls and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and excavation shall be cleaned of all trash and debris.

b. After inspection of foundation, walls, and pipes, backfill shall be placed symmetrically to prevent eccentric loading upon or against structures.

c. All backfill shall be compacted per Compaction of this specification.

3.05 APPLICATION

A. General:

1. Dispose of excavated materials which are not required or unsuitable for fill and backfill in lawful manner.

2. Dispose of surplus material on private property only when written permission agreement is furnished by owner of property. Submit copies of such agreements.

3. Obtain material required for fills in excess of that produced by excavation from borrow areas subject to the fill material requirements specified herein.

4. Rocks, broken concrete, or other solid materials larger than 4 inches in greatest dimension shall not be placed in fill areas, but removed from project sites at no additional cost to the Contract.

5. Stabilization of Subgrade: Provide materials used or perform work to stabilize subgrade so it can withstand loads which may be placed upon it by CONTRACTOR's equipment.

6. No material larger than 1” shall be placed in the first two feet below subgrade.

B. Excavation:

1. Excavations for Structures:

a. Dimensions and Elevations of Excavations: Provide excavations conforming to dimensions and elevations indicated on the Drawings for each structure, including trenching for adjacent piping and all work incidental thereto.

b. Soil of Unsuitable Bearing Value: Where soil is encountered having unsuitable bearing value, ENGINEER may direct in writing that excavation be carried to elevations above or below those indicated on the Drawings.

c. Unless directed by the ENGINEER, excavations shall not be carried below elevations indicated on the Drawings.

d. Bottom of Excavations for Structures: Consist of native material with top 6 inches compacted to 95 percent of maximum density and graded to conform to outside limits of structures as indicated on the Drawings, except where otherwise indicated on the Drawings or specified.

e. Underpin adjacent structures that could be damaged by excavating work.

f. Excavate to accommodate new structures and construction operations.

g. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

h. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

i. Cut utility trenches wide enough to allow inspection of installed utilities.

j. Hand trim excavations. Remove loose matter.

k. Grade top perimeter of excavation to prevent surface water from draining into excavation.

2. Necessary Over Excavation:

a. General:
1) Where it becomes necessary to excavate beyond normal lines of excavation in order to remove boulders or other interfering objects, backfill voids remaining after removal as specified in Backfilling of Voids, or as acceptable to the Engineer.
2) Perform necessary excavation beyond normal lines as specified above and backfill such voids.

b. Backfilling of Voids:
1) Fill voids with suitable material acceptable to the Engineer, placed in manner and to same uniform density as surrounding material.
2) With acceptance of the Engineer, concrete may be used.

C. Compaction:

1. Compacted Fills:

a. Lines and Grades:
1) Construct fills, and backfills, designated herein as fills, at locations and to lines and grades indicated on the Plans.

2. Where required, Contractor shall provide necessary imported fill material from outside sources.

a. Compacted Fill Shape and Sections: Provide completed fill that corresponds to shape of typical sections indicated on the Plans or that meets requirements for particular case.

b. Preparation of Areas Designated to Receive Fill Material: Scarify to minimum depth of 6 inches, unless otherwise indicated on the Drawings, and recompact to density of fill material as specified in following Article.

c. Fills and Backfills and Upper 6 Inches in Cuts: Compact to percentage

of maximum density as follows and as determined by ASTM D1557:
1) Backfill adjacent to structures: 95 percent.
2) Under present and future structures: 95 percent.
3) Under paved areas not subject to traffic loading, curbs, and sidewalks: 90 percent.
4) Under paved areas subject to traffic loading: 95 percent.
5) Other areas: 85 percent.
6) Demolition areas: 95 percent.

d. Placing Compacted Fills:
1) Placement: Place loose material in successive layers that do not exceed 8 inches in thickness after compaction.
2) Moisture Content: Bring each layer to specified moisture content for maximum density before compaction by rolling.
3) Each successive lift shall be firm and non-yielding under the weight of construction equipment.
4) Defective Compacted Fills: Remove and recompact.

3. Crushed rock shall be compacted by means of vibratory compaction equipment. At least three (3) pass from a flat plate vibratory compactor, number of passes shall be made as required until a firm unyielding state is achieved.

3.06 FIELD QUALITY CONTROL

A. Tests:

1. Confirmation Tests:

a. CONTRACTOR shall accomplish specified compaction for backfill, fill, and other earthwork.

b. CONTRACTOR may, at his option, arrange for conformation testing through his own forces or a testing laboratory.

c. Confirmation testing is only for the Contractor’s benefit and shall not substitute for Compliance Tests as specified herein.

d. Control operations in response to confirmation tests and City Compliance Testing to verify that compaction work complies, and is complying at all times, with requirements specified in this Section concerning compaction, control, and testing.

e. Cost of Confirmation Tests: Paid for by the CONTRACTOR.

f. Confirmation Test submittals are not required.

2. Compliance Tests:

a. Compliance tests will be made by the ENGINEER to verify that compaction is meeting requirements specified herein.

b. City’s Testing Laboratory will perform confirmation testing as acceptable to the ENGINEER.

c. CONTRACTOR shall coordinate with ENGINEER regarding the frequency of Compliance Testing and testing results.

d. Copies of Compliance Test Reports will be submitted promptly to the ENGINEER for disbursement to CONTRACTOR.

e. Coordination with ENGINEER Testing: Remove overburden above level at which the ENGINEER wishes to test and backfill and recompact excavation after testing is completed.

f. If compaction fails to meet specified requirements, perform remedial work by one of the following methods:
   1) Remove and replace backfill at proper density.
   2) Bring density up to specified level by other means acceptable to the ENGINEER.

g. Retesting:
   1) Costs of Retesting: Costs of retesting required to confirm and verify that remedial work has brought compaction within specified requirements shall be borne by the CONTRACTOR.
   2) City's Compliance Tests During Performance of Remedial Work will be performed as follows:
      a) Tests will be performed in a manner acceptable to the ENGINEER.
      b) Frequency: Double amount specified for initial confirmation tests.

B. Tolerances:

1. Finish Grading of Excavations, Backfill and Fills:

   a. Perform fine grading under concrete structures such that finished surfaces are never above established grade or approved cross section and are never more than 0.10 feet below.

   b. Provide finish surface areas outside of structures that are not more than 0.10 feet above or below established grade or accepted cross section.

2. Of Areas Which Are Not under Structures, Concrete, Asphalt, Roads, Pavements, Walks, Dikes and Similar Type Items:

   a. Provide finish graded surfaces of either undisturbed natural soil, or cohesive material not less than 6 inches deep.

   b. Intent of preceding is to avoid sandy or gravelly areas.

3. Finished Grading Surfaces:

   a. Reasonably smooth, compacted, and free from irregular surface changes.

   b. Provide degree of finish that is ordinarily obtainable from blade grader operations, except as otherwise specified.

   c. Uniformly grade areas which are not under concrete.

   d. Finish gutters and ditches so that they drain readily.

3.07 WET WEATHER AND WET SOIL CONDITIONS

A. To the maximum extent possible within schedule constraints, major excavation should take place during periods of suitable weather conditions.

B. The presence of shallow groundwater at the project sites is expected.

C. Shallow ground water could significantly impact underground construction. Impacts may include potentially wet and unstable pavement subgrade, difficulty achieving compaction, and difficult underground utility installation. Contractor shall make provisions to meet the specifications herein given the site conditions.

D. Surficial soils are anticipated to be loose sands, and with the presence of ground water, vertical excavations below the upper 3 feet may not stand vertical without shoring. The Contractor should anticipate shoring for excavations deeper than 3 feet. The Contractor should also anticipate raveling of excavations shallower than 3 feet.

E. When the moisture content of fill materials is significantly above optimum:

1. Scarify and air dry until fill materials have a suitable moisture content for compaction; or
2. Over-excavate the fill and replace with suitable on-site or import materials with an appropriate moisture content; and/or
3. Install a geotextile or geogrid to reinforce soft fill.
4. Chemically treat with lime, kiln-dust, or cement to reduce the moisture content and increase the strength of the fill.

3.08 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements, reference Section 02260 - Excavation Support and Protection.

3.09 CONTROL OF WATER

A. Water may be encountered within the Work at any time, and the presence of such water is likely to be continuous and rapidly flowing. Ground water levels are expected to be less than 5 feet below the existing ground surface and may be encountered in excavations deeper than 3 feet. Contractor shall control site water so that work may be done in the dry in a safe working environment according to relevant provisions of the Safety Orders.

B. Contractor shall assume dewatering will be required for controlling groundwater flow into excavations.

C. Contractor shall develop and submit a dewatering plan for review and approval. The dewatering design should maintain ground water at least 2 feet below the bottom of the mass excavation, and at least to the bottom of localized excavation such as for manholes and utilities. Contractor shall have a backup power source available for the dewatering system at all times during the dewatering operation.

D. The Contractor may obtain a wastewater discharge permit from the East Bay Municipal Utility District (EBMUD) to discharge dewatering disposal water to the City's sewer system. The Contractor is responsible for applying for, paying for, and meeting all of the EBMUD permit requirements.

   1. The Contractor shall remove sediment from the disposal water prior to disposing into the sewer system. The sediment removal method shall meet the requirements of the EBMUD permit (filtered with Whatman 934 AH Glass Microfiber filter, or equivalent).

E. If the Contractor chooses to discharge any water the storm drain system, the Contractor shall adhere to the requirements within the State Water Resources Control Board NPDES General Permit Requirements (Order No. 2009-0009-DWQ) for Risk Level 1 sites. The Contractor shall also obtain a waste discharge permit from the Regional Water Quality Control Board (RWQCB). Permit requirements (Order No. 2009-0009-DWQ) are available for download on the State Water Resource Control Board's website (http://www.waterboards.ca.gov).

F. During excavation operations, if the Contractor encounters suspected contaminated water, the Contractor shall immediately implement the CSEDWP and stop the disposal of excavated groundwater. Any non-contaminated water that becomes mixed with contaminated water shall be designated as contaminated water and shall be handled and disposed as such at no additional cost to the City. Contractor will not be paid for handling and disposal of the volume of non-contaminated water at the negotiated contaminated price, if it is mixed with contaminated water.

G. If contaminated water is discovered, the Contractor shall identify a minimum of one disposal site that is permitted to and will accept the contaminated water expected for disposal. The Contractor shall select facilities that are established, fully operational, and in full compliance with all applicable federal, state, and local regulations.

H. All construction equipment used for the handling of contaminated material shall be decontaminated prior to use for other work elements or removal from site.

I. Prior to the preparation of bedding or subgrade, the excavation shall be thoroughly dewatered by the use of sump pumps and dewatering equipment as necessary to safely convey water away from structural excavations.

J. The Contractor shall prevent surface water (e.g. rainwater) and subsurface or groundwater from flowing into excavations and from flooding the project sites and surrounding areas.

K. The Contractor shall remove all water which accumulates in all excavations during the progress of work so that all work can be done in the dry. Excavated areas shall be kept free from water while structures are constructed, while concrete is setting and until backfill has been placed to a sufficient height to anchor the work against possible floatation.

L. Contractor shall implement sufficient measures to limit the inflow of groundwater so that the maximum allowed dewatering pumping rate of 50 gpm is sufficient to keep excavated areas free from water.

M. Sufficient pumping equipment for immediate use shall be on the project sites at all times, including standby pumps for use in case other pumps become inoperable. Water shall be disposed of so as to cause no injury to public or private property, or to be a menace to the public health.

N. Dewatering devices shall be adequately filtered to prevent the removal of fines from the soil.

O. The Contractor shall be responsible for any damage to foundations or other parts of existing structures or of the new work, caused by the failure of any part of the Contractor's protective works.

P. Depending upon groundwater conditions and the degree of project completion, underground structures are susceptible to floatation prior to backfill and anchorage. Contractor shall prevent the floatation or movement of structures during construction.

Q. After dewatering is no longer necessary, all dewatering pumps and appurtenances shall be removed by the Contractor.

3.10 ADJUSTING

A. Finish Grades of Excavations, Backfilling and Fill:

1. Repair and reestablish grades to required elevations and slopes due to any settlement or washing way that may occur from action of the elements or any other cause prior to final acceptance.
2. Protect newly graded areas from action of the elements.
3. Maintain optimum moisture content of fill materials to attain required compaction density.
4. Correct areas that are over-excavated.

END OF SECTION

SECTION 02318
TRENCHING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Trench excavation, fine grading, pipe bedding, backfilling, and compaction for the following:

1. Electrical conduits.
2. Pull boxes and other accessories.

B. Related Sections:

1. Section 02300 - Earthwork.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. C 131 - Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
2. C 136 - Test Method for Sieve Analysis of Fine and Course Aggregates.
3. D 1556 - Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
4. D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.lbf/ft^3 (2,700 kN.m/m^3)).
5. D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.03 SUBMITTALS

A. Products Data: For all proposed bedding and backfill materials.

1. Material source.
2. Gradation.
3. Testing data and testing laboratory qualifications including lab certification.

B. Trench excavation plan, drawings, and calculations.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:

1. Provide bedding and backfill material as shown on the plans and per Section 02300.

PART 3 EXECUTION

3.01 PREPARATION

A. General:

1. Trench Condition:

a. Install pipe, conduit, and materials as specified herein and detailed on the Drawings.

2. Embankment Condition:

a. Exists where width of pipe trench exceeds limits specified herein.

b. Before laying pipes or electrical conduits in fill, place fill and compact it to not less than 2 feet above top of pipe or conduit.

c. After placing and compacting fill, excavate through fill and fine grade as required in this Section.

B. Control of Water: See Section 02300-3.09

3.02 INSTALLATION

A. Trench Excavation:

1. General Requirements:

a. If because of soil conditions, safety requirements or other reasons, trench width at top of pipe is increased beyond width specified in this Section and shown on the plans, upgrade laying conditions, or install stronger pipe designed in conformance with Specifications for increased trench width, without additional cost.

b. Pipe and Electrical Conduits:

1) Lay pipe and electrical conduits in open trench; install pipe bedding as shown on the Plans.

2) If bottom of excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to provide uniform bearing surface, remove such rock or other material to a depth of not less than 4 inches below bottom of pipe and refill to grade with bedding material placed at uniform density, with minimum possible compaction, at no additional cost.

3) If bottom of excavation is found to consist of soft or unstable material which is incapable of properly supporting pipe, remove such material to a depth and for the length required, as determined by the ENGINEER, and then refill trench to grade with crushed rock and compacted to 90 percent maximum density.

4) In all locations where Bay Mud is encountered stabilization fabric (Mirafi 140N or approved equal) shall be placed at the bottom of the final excavation, on the sides, and on top of the bedding material. Minimum overlap of the filter fabric shall be 12 inches.

c. Trench Widths: as shown on drawings

d. At Road Crossings or Existing Driveways:

1) Make provision for trench crossings at these points, either by means of backfills, tunnels, or temporary bridges.

B. Pipe Bedding:

1. Bedding material shall be as scheduled herein unless otherwise specified or shown on the drawings.

2. Pipe Displacement:

a. Take necessary precautions in placement and compaction of bedding material to prevent displacement of piping.

b. In event there is movement or floating, re-excavate, re-lay, and backfill the pipe.

C. Trench Backfill:

1. Backfill material shall be as specified in Section 02300.

2. Place and compact backfill in accordance with following requirements:

a. From 6 inches above top of pipe to natural surface level. Match finish grade as indicated on the Drawings.

b. Trench Backfill from 6 inches above top of pipe to finish grade with backfill material compacted to 95 percent of maximum density.

c. Existing Conditions: Where existing underground pipes or conduits larger than 3 inches in diameter cross trenches above new work:

1) Backfill from bottom of intersecting trench to spring line of intersecting pipe or conduit with backfill material compacted to 90 percent of maximum density when tested in accordance with ASTM D 1556 or ASTM D 2922.

a) Provide controlled density fill material below existing pipe or conduit where backfill cannot be placed and compacted as specified. Controlled density fill shall have a minimum thickness of 12 inches beneath the existing pipe or conduit and shall extend up to the springline of the pipe or conduit. Controlled density fill shall extend a minimum of 12 inches beyond the outside of the pipe or conduit in either direction and as a minimum shall extend to the edge of the trench crossing the pipe or conduit.

2) Extend backfill material 2 feet on either side of intersecting pipe or conduit to ensure that material remains in place while other backfill is placed.

d. Backfill shall be mechanically compacted at optimum moisture content or above according to ASTM D1557 with vibratory equipment weighing no more than 12 tons static weight. All backfill shall be placed in maximum 8-inch lifts. Water settling methods such as flooding and poling or jetting are prohibited.

D. Native or Import Material:

1. Native or Import material meeting the requirements within Section 02300 shall be used as backfill.

E. Excess Material:

1. Remove excess excavated material and any excavated Bay Mud from the project site and dispose of legally off-site.

3.03 FIELD QUALITY CONTROL

A. Shall meet the compaction and testing requirements in Section 02300-3.06

END OF SECTION

SECTION 02722
AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Aggregate base course.

1.02 REFERENCES

A. American Society of Testing and Materials (ASTM):

1. C 117 - Test Method for Material Finer than 75 ΦM (Number 200) Sieve in Mineral Aggregate by Washing.
2. C 136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
3. D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

B. State of California Department of Transportation.

1. Caltrans - Standard Specifications.

1.03 SUBMITTALS

A. Product Data:

1. Source, gradation, and testing data for aggregate base course.

B. Quality Control:

1. Test Reports: Reports for tests required by Sections of Caltrans Standard Specifications.
2. Certificates of Compliance: Certificates as required by Sections of Caltrans Standard Specifications.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Protect from segregation and excessive moisture during delivery, storage, and handling.

B. Shall meet the requirements within Section 01140.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate Base Course:

1. Class 2, 3/4-inch maximum aggregate size free from vegetable matter and other deleterious substances, and of such nature that aggregate can be compacted readily under watering and rolling to form a firm, stable base.
2. Materials derived from processing demolished or removed asphalt concrete are not acceptable.
3. Coarse aggregate material retained in Number 4 sieve shall consist of material of which at least 25 percent by weight shall be crushed particles when tested in accordance with California Test 205.
4. Aggregate shall not be treated with lime, cement, or other chemical material before the Durability Index test is performed.
5. Aggregate grading and sand equivalent tests shall be performed to represent not more than 500 cubic yards or one day's production of material, whichever is smaller.
6. Grade within the limits and conform to quality requirements as follows when tested in accordance with California Test 202:

Sieve Sizes (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90-100
Number 4	35-55
Number 30	10-30
Number 200	2-9

Quality Requirements		
Description	California Test	Minimum Test Result
Resistance (R Value)	301	78
Sand Equivalent	217	22
Durability Index	229	35

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine conditions upon which the work specified in this Section depends for defects that may influence installation and performance.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Subgrade Preparation: Prepare as specified in Section 02300, "Earthwork."

3.03 INSTALLATION

A. Furnish, spread, and compact aggregate base course material to the lines, grades, and dimensions indicated on the Drawings.

1. Aggregate bases, after compaction, shall be watered in conformance with the provisions in Section 17, “Watering”, of the Caltrans Standard Specifications.
2. The relative compaction of each layer of compacted base material shall be not less than 95 percent.
3. The surface of the finished aggregate base at any point shall not vary more than 0.05 foot above or below the grade established by the Engineer.
4. Spreading: Spread in accordance with sections of Caltrans Standard Specifications.
5. Compacting: Compact in accordance with sections of Caltrans Standard Specifications.

3.04 FIELD QUALITY CONTROL

A. Tests: Perform tests and meet the requirements within Section 02300-3.06.

END OF SECTION

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SECTION 02770
PIPE SYSTEM TESTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Testing of sanitary sewer systems.

B. Related Sections:
   1. Section 02318 – Trenching.
   2. Section 03300 – Cast in Place Concrete
   3. Section 03400 – Precast Concrete
   4. Section 15100 – Pipe, Fittings, and Valves

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C 969 – Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
   2. C 1091-03a – Test Method for Hydrostatic Infiltration Testing of Vitrified Clay Pipe Lines
   3. F 1417 – Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air
   4. F 2164 – Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
   5. D 3034 – Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
   6. F 1667 – Guide for Construction Procedures for Buried Plastic Pipe

B. Uni-Bell PVC Pipe Association
   1. B-6 – Recommended Practice for low Pressure Air Testing of Installed Sewer Pipe

PART 2 PRODUCTS

2.01 GENERAL

A. Mandrels, temporary plugs, bypass pumping, low-pressure testing equipment and all other necessary materials shall be provided by the Contractor, subject to the City's approval. All testing shall be performed by the Contractor in the presence of the City's representative. No materials shall be used which would be injurious to the public, personnel, adjacent improvements or the pipeline.

2.02 PRESUUSRE GAUGES

A. Pressure gauges shall be laboratory-calibrated test gauges and shall be recalibrated by a certified laboratory prior to the leakage test. Gauge shall be easy to read in no more than one (1) pound per square inch (psi) increments and have a maximum full-scale range of five (5) psi.

PART 3 EXECUTION

3.01 WET WELL TESTING

A. New precast concrete wet well shall be hydrostatically leak tested prior to acceptance and prior to coating as specified below:

1. Test Procedure:

a. Plug all inlets and outlets with temporary plugs

b. Fill structure with potable water

c. Let stand for 24 hours

d. Fill to rim of structure

e. Let stand for 2 hours

f. Calculate water loss. Leakage shall not exceed 0.1 gallon per hour per foot of water depth during the test.

2. Repair all structures which do not meet the test requirement. Re-test structure until it passes.

3.02 FORCE MAIN TESTING

A. Testing of new force main pipe shall be in accordance with ASTM F2164. Contractor shall provide all equipment and personnel necessary to properly test. Testing shall be done in the presence of the City inspector.

B. Newly installed force main pipe shall be tested with dechlorinated potable water unless otherwise approved by the City.

C. Testing shall be done after the pipe has been fully installed and backfilled. Ensure thrust restraints have been installed and allow sufficient time for any required concrete thrust blocks to achieve required sufficient strength.

D. Testing shall not be done only when the temperature of pipe is 80 degree Fahrenheit or less.

E. Testing against closed valves is not recommended. Contractor shall blind flange before the closed valve.

F. Testing Procedure:

1. Fill the pipeline with water at a maximum velocity of 10-feet per minute and bleed off any trapped air.

2. Gradually increase the pressure so the lowest element in the system achieves a test pressure that is 1.5 times the pipe design pressure or 150 psi, whichever is less. Monitor pipe for any leaks.

3. Provide additional water to maintain sufficient test pressure. After the pipe has been pressurized at test pressure for 4 hours, testing can begin.

4. To test, reduce test pressure by 10 psi and stop adding test liquid. Monitor the pressure for 1 hour. Test pressure shall remain within 5% of the target value, and no visual leakage shall occur. If pipe does not pass these requirements, contractor shall repair leaks and retest the pipe.

G. All plugs shall be adequately braced and restrained to support the full load developed. No workers shall be allowed in the excavation, vault, or manhole while the line is under pressure. The Contractor shall make provisions for reading the pressure at the ground surface and for safely releasing the pressure without entering the manhole or excavation.

H. Under no circumstance shall the pipe be pressurized over the design pressure for more than 8 hours. If the test is not complete within this time limit, the pipeline shall be depressurized at or below the design pressure and allowed to "relax" for at least 8 hours before testing.

I. **TEST REPORT:** Contractor shall prepare and submit a report detailing all pipes tested. The report shall include the pipe location, pipe size, upstream and downstream testing locations, testing date, testing pressure, recorded leakage, test time, and test date. The report shall be submitted to the City within one week of performing the test. The City will review the report and if acceptable the City will sign the report for acceptance of the test.

*****END OF SECTION*****

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SECTION 02772
CONCRETE CURBS, GUTTERS, AND SIDEWALKS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Concrete curbs, gutters, sidewalks, driveways and access ramps to replace those demolished or damaged during construction.

B. Related Sections:

1. Section 03300 – Reinforced Concrete.

C. Concrete work to replace structures demolished as necessary to accomplish the Work as described in the Plans and Specifications shall be paid for in the item of work that necessitates the demolition. Replacing existing concrete work intentionally or unintentionally damaged during the course of construction operations, which is not shown as needing to be demolished on the Plans, shall be the responsibility of the Contractor and no additional compensation will be made thereto.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements: Construct various types of concrete curb, gutter, sidewalk, driveways, and ramps to dimensions and details indicated on the Drawings or to replace the damaged facility in kind, as directed by the Engineer.

1.03 SUBMITTALS

A. Product Data: Submit data completely describing products.

B. Samples: Submit samples when requested.

1.04 SEQUENCING AND SCHEDULING

A. Schedule placing of concrete in such manner as to complete any single placing operation to construction, contraction, or expansion joint.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Shall conform to the applicable requirements of Section 03300.

B. Curb Finishing Mortar: 1 part Portland cement to 2 parts sand.

C. Form Release Material: Light oil or other releasing agent of concrete type that does not discolor concrete or interfere with the application of finishing mortar to curb tops and faces.

D. Joint Materials:

1. Expansion: Comply with requirements as specified in Section 03300.
2. Construction: Steel dividers or plastic inserts.

E. Concrete Coloring: As specified in Section 03300.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Verify field conditions, including subgrade condition and interferences, before beginning construction.

3.02 PREPARATION

A. Removal of Existing Concrete

1. All damaged concrete shall be removed and replaced by the Contractor at the Contractor's expense.
2. All concrete curbs, gutters, and sidewalks to be removed shall be removed and replaced to the nearest existing cold joint.

B. Surface Preparation:

1. Subgrade:
   a. Construct and compact true to grades and lines indicated on the Drawings and requirements as specified in this section.
   b. Remove soft or unsuitable material to depth of not less than 6 inches below subgrade elevation and replace with satisfactory material.
2. Forms And Subgrade: Water immediately in advance of placing concrete.

3.03 PROJECT CONDITIONS

A. Environmental Requirements:

1. Hot Weather Concreting:
   a. When Ambient Air Temperature Is above 90 Degrees Fahrenheit: Prior to placing concrete, cool forms and reinforcing steel to by water cooling to below 90 degrees Fahrenheit.
   b. Temperature of Concrete Mix at Time of Placement: Keep temperature below 90 degrees Fahrenheit by methods which do not impair quality of concrete.
2. Cold Weather Concreting:
   a. Concrete placed below ambient air temperature of 45 degrees Fahrenheit and falling or below 40 degrees Fahrenheit: Make provision for heating water.

b. If materials have been exposed to freezing temperatures to degree that any material is below 35 degrees Fahrenheit: Heat such materials.

c. Heating Water, Cement, or Aggregate Materials:
   1) Do not heat in excess of 160 degrees Fahrenheit.

d. Protection of Concrete in Forms:
   1) Protect by means of covering with tarpaulins, or other acceptable covering.
   2) Provide means for circulating warm moist air around forms in manner to maintain temperature of 50 degrees Fahrenheit for at least 5 days.

B. For conditions that promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind: Take corrective measures to minimize rapid water loss from concrete.

a. Furnish and use sufficient number of maximum and minimum self-recording thermometers to adequately measure temperature around concrete.

3.04 INSTALLATION

A. Special Techniques:

1. Contractor's Option:

a. Construct concrete curbs and gutters by conventional use of forms, or by means of curb and gutter machine when acceptable to the Engineer.

b. When use of machines designed specifically for work of this Section are accepted by the Engineer, results must be equal to or better than those produced by use of forms.

c. Applicable requirements of construction that apply to use of forms also apply to use of machines.

d. Discontinue use of machines when results are not satisfactory to the Engineer.

B. Forms:

1. Carefully set to line and grade and securely stake in position forms conforming to dimensions of items to be constructed.

2. Thoroughly clean prior to each use and coat with form releasing material.

C. Expansion and Contraction Joints:

1. Expansion Joints:

a. Construct vertically, and at right angles to centerline of street and match joints in adjacent pavement or sidewalks.

b. Constructed at radius points, driveways, alley entrances, and at adjoining structures.

c. Fill joints with expansion joint filler material.

2. Contraction Joints:

a. Constructed not more than 15 feet apart.

b. Make joints of construction joint material, scoring or saw cutting to depth of not less than 1-1/2 inches and matching joints in adjacent pavement or sidewalk.

D. Concrete:

1. Placing:

a. Thoroughly spade concrete away from forms so that no rock pockets exist next to forms and so that no coarse aggregate will show when forms are removed.

2. Compacting:

a. Compact by mechanical vibrators accepted by the Engineer.

b. Continue tamping or vibrating until mortar flushes to surface and coarse aggregate is below concrete surface.

3. Form Removal:

a. Front Form Faces: Do not remove before concrete has taken initial set and has sufficient strength to carry its own weight.

b. Gutter and Rear Forms: Do not remove until concrete has hardened sufficiently to prevent damage to edges. Take special care to prevent damage.

4. Finishing and Curing:

a. As soon as curb face forms are stripped, apply finishing mortar to the top and face of curb and trowel to a smooth, even finish. Finish with fine haired broom in direction of work.

b. Where curb is installed without integral gutter, extend finish 2 inches below grade.

c. Edge concrete at expansion joints to 1/4-inch radius.

d. Flow lines of gutters shall be troweled smooth 4 inches out from curb face for integral curb and gutter and 4 inches on both sides of flowline 4 gutters without curbs.

E. Backfilling:

1. Unless otherwise specified, backfill behind curbs, gutters, or sidewalks with soil native to area and to lines and grades indicated on the Drawings.

3.05 FIELD QUALITY CONTROL

A. Tests:

1. Curbs and Gutters:

a. Test face, top, back, and flow line with 10-foot straightedge or curve template longitudinally along surface.

b. Correct deviations in excess of 1/4 inch.

2. Gutters:

a. Frequency of Testing: When required by the Engineer, where gutters have slope of 0.8 foot per hundred feet or less, or where unusual or special conditions cast doubt on capability of gutters to drain.

b. Test Method: Establish flow in length of gutter to be tested by supplying water from hydrant, tank truck, or other source.

c. Required Results:
   1) 1 hour after supply of water is shut off, inspect gutter for evidence of ponding or improper shape.
   2) In event water is found ponded in gutter to depth greater than ½-inch, or on adjacent asphalt pavement, correct defect, or defects in manner acceptable to the Engineer without additional cost to the Contract.

3.06 ADJUSTING

A. Repair portions of concrete damaged while stripping forms or, when damage is severe, replace such work at no additional cost to the Contract. Evidence of repairs shall not be noticeable in the finished product.

B. Remove and replace sections of work deficient in depth or not conforming to requirements indicated on the Drawings and specified in the Specifications at no additional cost to the Contract. Removal and replacement shall be the complete section between two joints.

END OF SECTION

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SECTION 02860
PICKET FENCE AND GATE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. New fencing, posts, gates and, and associated hardware as shown on the drawings and specified herein.

B. The intent of this specification is to provide for a complete installation in a workmanlike and professional manner. Not all required materials, installation procedures, or hardware may be specifically referred to.

C. Related Work Specified Elsewhere:

1. Section 01330 - Submittal Procedures.
2. Section 02200 - Site Preparation.
3. Section 03300 – Reinforced Concrete.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM B221 – Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
3. ASTM D1654 – Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
4. ASTM D2794 – Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
5. ASTM D3359 – Test Method for Measuring Adhesion by Tape Test.
6. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.03 MANUFACTURER'S QUALIFICATIONS

A. Fence, gates, and accessories shall be products of manufacturers' regularly engaged in manufacturing items of type specified.

1.04 SUBMITTALS

A. In accordance with Section 01330.

B. Shop Drawings:

1. Detailed information and specifications for materials and finishes.

2. Layout of fence and gates with dimensions, details, and finishes of component accessories and post foundations.

3. Gate elevations, hardware details, and complete installation details.

C. Product Data:

1. Manufacturer’s catalog cuts indicating material compliance, specified options, and installation instructions.

2. Provide 4 copies of operation and maintenance data covering the installed products, to the City. Including name, address, and telephone number of the nearest fully equipped service center.

D. Samples: Approximately 6-inch lengths of posts, rails, slats, and fittings.

E. Quality Control Submittals:

1. Installer Qualifications:

a. Engage a single installer regularly engaged in fence installation and with successful experience in the installation of the types of materials required, and who agrees to employ only tradesmen with specific skill and successful experience in this type of Work.

b. Submit name and qualifications to the City for review and approval.

2. Manufacturer’s supervision: Manufacturer authorized representative must supervise installation of the gates and submit a written report at completion of installation stating that installations were made in compliance with the equipment Manufacturer's instructions.

3. Warranty: Provide a 1-yr warranty on all equipment from date of start-up. Warranty shall cover defects in workmanship, design, and materials. If any component should fail during the warranty period, it shall be corrected, and the unit restored to service at no expense to the City.

PART 2 PRODUCTS

2.01 PRODUCT AND MANUFACTURER

A. The fence and gate system shall consist of a welded steel fence and gates. The fence and gate system shall be the product of a single manufacturer.

B. Manufacturer and Model.

1. Ameristar Fence Products, Inc.

a. Fence: Montage II fence in the Majestic style with 3-rail design and flush bottom rail

2. Swing Gate: Montage II Genesis Gate, style and rail design to match the fence.

3. Or approved equal.

2.02 FABRICATION

A. Fence Height: As shown on the plans.

B. Fence Color: Black, provide color sample to the City for review and approval prior to fabrication.

C. Slats, rails, uprights, diagonal bracing, and posts shall be cut to lengths necessary to achieve the required height. Rails shall be punched to accept pickets. Cutting and punching shall be done prior to coating to facilitate assembly without compromising the integrity of the finish.

D. Fence:

1. The fence shall be furnished in factory-assembled standard panels. The panels shall be attached the posts with brackets supplied by the fence system Manufacturer.
2. Slats shall be inserted into the punched holes in the rails and shall be aligned to standard spacing.
3. The aligned slats and rails shall be welded at each slat-to-rail intersection, providing a rigid panel assembly.
4. The existing ground surface is uneven, the fence posts and slats shall be cut to varying lengths as necessary such that the top of the fence is flush.

E. Pedestrian swing gates:

1. Shall be self-closing, having a gate leaf size as shown on the plans.
2. Integrated hinge-closer set (2 qty) shall be ADA compliant that shall include a variable speed and final snap adjustment with compact design (no greater than 5” x 6” footprint).
3. Hinge-closer set (2 qty) shall be tested to a minimum of 500,000 cycles and capable of self-closing gates up to a maximum gate weight of 260 lbs. and maximum weight load capacity of 1,500 lbs.
4. Hinge-closer device shall be externally mounted with tamper-resistant security fasteners, with full range of adjustability, horizontal (.5” - 1.375”) and vertical (0 - .5”).
5. Maintenance free hinge-closer set shall be tested to operate in temperatures of negative 20 F to 200 F degrees, and swings to negative 2 degrees to ensure reliable final lock engagement.

F. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for industrial weight fences under ASTM F2408.

G. Posts shall have a square cap firmly affixed to the extending end.

2.03 MATERIALS

A. Fence

1. Steel used for slats, rails, and posts shall conform to the requirements of ASTM A653/A653M.
    a. Steel components shall have a minimum yield strength of 45,000 psi.
    b. Steel shall be hot-dip galvanized with a minimum zinc coating weight of 0.90 oz./sq. ft.
2. Slats:
    a. 1-inch square tubular members
    b. Minimum thickness: 14 gauge
    c. Maximum face to face slat spacing: 4-¾ in. on center
3. Rails:
    a. 1-¾ in. x 1-¾ in. steel channel
    b. Minimum steel thickness of 0.105 in.
4. Posts:
    a. 2-½ in. square tubular members
    b. Minimum thickness: 12 gauge
5. Coating:
    a. Galvanized steel fence components shall be subjected to a wash and pretreatment process that includes a zinc phosphatizer and a non-chromate sealer, followed by an epoxy primer and an acrylic topcoat.
    b. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils.
    c. The color shall match the fence components used at the adjacent Alameda Municipal Golf Course.
    d. The coated panels and posts shall be capable of meeting the following performance requirements:
        1) Adhesion per ASTM D3359 Method B: Over 90% of test area
        2) Corrosion resistance per ASTM D1654: Over 1,500 hours
        3) Impact resistance per ASTM D2794: over 60 in.-lb. from forward impact using 5/8-inch ball

B. Gates
1. Gate opening dimensions shall be as shown on the Drawings.
2. Aluminum used for uprights, diagonal braces, slats and rails shall conform to the requirements of ASTM B221, designation 6063-T-6.
    a. Aluminum components shall have a minimum yield strength of 25,000 psi and a minimum tensile strength of 30,000 psi.
    b. Aluminum shall have a standard mill finish.
3. Diagonal Bracing and Uprights:
    a. 2-inch square aluminum

b. Minimum thickness of 1/4 in.

c. Uprights shall be equally spaced at no more than 8 ft. on center.

4. Slats:

   a. 1-inch square aluminum

   b. Minimum thickness of 1/8 in.

5. Rails:

   a. 5 in. x 2 in. aluminum

   b. Minimum thickness of 1/4 in.

6. Posts:

   a. 4 in. square tubular steel members conforming to the requirements of ASTM A653/A653M.

   b. Steel posts shall have a minimum yield strength of 45,000 psi.

   c. Steel shall be hot-dip galvanized with a minimum zinc coating weight of 0.90 oz./sq. ft.

   d. Minimum steel thickness: 5/16 in.

   e. Post spacing shall be as shown on the Drawings

7. Accessories:

   a. Gate hangers, latches, brackets, guide assemblies, and stops shall be aluminum, malleable iron, or steel, galvanized after fabrication.

   b. Each gate shall be provided with a positive latch device for padlocking and a key safe for fire department access.

   c. The key safe shall be a black surface mount model provided without a tamper switch, Knox-Box Model 3201.

8. Coating:

   a. Gate components shall be subjected to a thermal stratification coating process. The coating process shall include, at a minimum, a wash and pre-treatment process followed by an electrostatic spray application of a polyester finish.

   b. The topcoat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils.

   c. The color shall match the fence.

   d. The gate components and posts shall be capable of meeting the following performance requirements:
      1) Adhesion per ASTM D3359 Method B: Over 90% of test area
      2) Corrosion resistance per ASTM D1654: Over 3,500 hours
      3) Impact resistance per ASTM D2794: over 60 in.-lb. from forward impact using 5/8-inch ball.

2.04 CONCRETE

A. As specified in Section 03300.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fence with a properly trained crew, on previously prepared surfaces, to lines and grades as shown.

B. Supply accessories and hardware as required and recommended by the manufacturer, to accommodate the installation of a complete fence and gate system.

C. Install fences and gates in accordance with fence Manufacturer's recommendations, as approved by ENGINEER. Erect fencing in straight lines between angle points.

3.02 PREPARATION

A. Establish locations of fence lines, gates, and terminal posts.

B. Embedment Coating: Coat portion of galvanized or aluminum-coated steel posts that will be embedded in concrete per Section 09960, Coatings.

3.03 FENCE INSTALLATION

A. Fence Post Setting:

1. Driven posts are not acceptable.
2. Concrete Set Posts:
    a. Drill hole in firm, undisturbed, or compacted soil.
    b. Post Hole Depth:
        1) Minimum 3 feet below finished grade.
        2) 2 inches deeper than post embedment depth below finish grade.
    c. Space posts as shown on the Drawings. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade.
    d. Backfill post holes with concrete to 2 inches above finished grade. Minimum concrete footing diameter is 12 in. Before concrete sets, crown and finish top of concrete to readily shed water.
3. Check each post for vertical and top alignment. Maintain position during placement and finishing.

B. Fence Panel Installation:

1. Panels shall not be attached to posts until concrete post footing has cured to sufficient strength.

2. Panels shall be attached to posts with brackets supplied by the Manufacturer.
3. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces:
    a. Remove all metal shavings from cut area.
    b. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole and allow primer to dry.
    c. Apply 2 coats of custom finish paint matching fence color.
    d. Primer and finish paint shall be Manufacturer-approved products.

C. Gate Installation:

1. Install gates plumb, level, and secure for full opening without interference. Hang gates and adjust hardware so gates operate satisfactorily and smoothly from open or closed position.
2. Install gates according to manufacturer's instructions.
3. Install gates according to Manufacturer's instructions.
4. Gate stops shall be installed on each track in a way that conforms to current ASTM F1184 standards.
5. Attach hardware by means which will prevent unauthorized removal.

3.04 FIELD QUALITY CONTROL

A. Gate Tests: Prior to acceptance of installed gates and gate operator systems, demonstrate proper operation of gates under each possible open and closed condition.

3.05 FINAL CLEAN-UP

A. Remove all debris, rubbish, and excess material from the station site.

END OF SECTION

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SECTION 02990
PAVEMENT RESTORATION AND REHABILITATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Resurfacing roads and paved surfaces in which surface is removed or damaged by installation of new work.

B. Related Sections:

1. Section 02772 - Concrete Curbs, Gutters, and Sidewalks.
2. Section 03300 – Reinforced Concrete.

C. Restoration work to replace or rehabilitate pavement demolished as necessary to accomplish the Work as described in the Plans and Specifications shall be paid for in the item of work that necessitates the demolition. Replacing existing pavements intentionally or unintentionally damaged during the course of construction operations, which is not shown as needing to be demolished on the Plans, shall be the responsibility of the Contractor and no additional compensation will be made thereto.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Limiting Dimensions:

a. Determine the exact lengths and dimensions of such roads, pavements, parking areas, and walks that will require removal and replacement for restoration.

b. Join existing surfaces to terminals of new surfacing in smooth juncture.

1.03 SUBMITTALS

A. Mix Designs:

1. Prior to placement of asphalt concrete, submit full details, including design and calculations for the asphalt concrete mix proposed.
2. Submit gradation of aggregate base.
3. Submit proposed mix design of portland cement concrete.

PART 2 PRODUCTS

2.01 AGGREGATE BASE COURSE

A. Aggregate base course shall meet the requirements of specification Section 02722 Aggregate Base Course.

2.02 ASPHALT PAVEMENT MATERIALS

A. Asphalts:

1. Asphalt Binder: Steam-refined paving asphalt, Performance Grade 64-10, conforming to Section 92-1.02 “Grades” of the Caltrans Standard Specifications.
2. Prime Coat and Tack Coat: Grade SC-70, conforming to Section 93-1.01 of the Caltrans Standard Specifications.
3. Fog Seal: Asphaltic Emulsion, Grade SS-1h, conforming to Section 94-1.02 of the Caltrans Standard Specifications.

B. Asphalt Aggregate:

1. Aggregate for asphalt concrete shall conform to Section 39 of the Caltrans Standard Specifications for Type A, 1/2-inch maximum grading.

C. Asphalt pavement shall be produced in a batch mixing plant, a continuous pugmill mixing plant, or drier-drum mixing plant.

1. Storage shall conform to section 39-3.01 and Section 39-3.05 of the Caltrans Standard Specifications.
2. Drying shall conform to Section 39-3.02 of the Caltrans Standard Specifications.
3. Proportioning shall conform to Section 39-3.03 of the Caltrans Standard Specifications.
4. Mixing shall conform to Section 39-3.04 of the Caltrans Standard Specifications.

2.03 PORTLAND CEMENT PAVEMENT

A. Conform to the requirements of Section 03300.

2.04 SOURCE QUALITY CONTROL

A. The Engineer will perform sampling and tests of materials in accordance with California Test Method Number 304 and California Test Method Number 362 or 379, as applicable. Samples will be taken from materials as delivered to the site.

2.05 EQUIPMENT

A. Roads, Pavements, Parking Areas, and Walks:

1. Equipment Requirements: Good condition, capable of performing work intended in satisfactory manner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Aggregate Surface Removal Replacement:

1. When trench cut is in aggregate surfaced areas, replace aggregate base course material with material matching existing material compacted to 95 percent of its maximum density. Depth of aggregate base course shall match depth of existing aggregate base course or shall be a minimum of 6 inches, whichever is greater, unless otherwise indicated on the Drawings.

B. Pavement Removal and Temporary Asphalt Replacement:

1. Install temporary asphalt pavement or first course of permanent pavement replacement immediately following backfilling and compaction of trenches that have been cut through existing pavement.
2. Except as otherwise provided, maintain this temporary pavement in a safe and reasonably smooth condition until required permanent pavement is installed.
3. Remove and dispose of temporary paving from project site.
4. Where longitudinal trench is partly in pavement, replace pavement to original pavement edge, on a straight line, parallel to centerline of roadway.
5. Where no part of longitudinal trench is in pavement, surfacing replacement shall only be required where existing surfacing materials have been removed.

3.02 AGGREGATE BASE INSTALLATION

A. Furnish, spread, and compact aggregate base course material to the lines, grades, and dimensions indicated on the Plans.

1. Spreading: Spread in accordance with sections of Caltrans Standard Specifications.
2. Compacting: Compact in accordance with sections of Caltrans Standard Specifications to the relative compactions specified in relevant sections of these specifications**.**

3.03 ASPHALT PAVEMENT REPLACEMENT

1. Replace asphalt pavement to same thickness as adjacent pavement and match as nearly as possible adjacent pavement in texture.

2. Cut existing asphalt pavements to be removed for trenches or other underground construction by wheel cutter, clay spade, or other device capable of making neat, reasonably straight, and smooth cut without damaging adjacent pavement. Cutting device operation shall be subject to acceptance of Engineer.

3. Cut and trim existing pavement after placement of required aggregate base course and just prior to placement of asphalt concrete for pavement replacement, and paint trimmed edges with material for painting asphalt concrete pavement immediately prior to constructing new abutting asphalt pavements. No extra payment will be made for these items, and all costs incurred in performing this work shall be incidental to pipe laying or pavement replacement.

4. Conform replacement of asphalt pavement to contour of original pavement.

B. Portland Cement Concrete Pavement Replacement:

1. Where trenches lie within Portland cement concrete section of streets, alleys, sidewalks, and similar concrete construction, saw cut such concrete (to a depth of not less than 1-1/2 inches) to neat, vertical, true lines in such manner adjoining surfaces are not damaged.

2. Place portland cement concrete replacement material to dimension as indicated on the Drawings.

3. Provide expansion joints that match existing.

4. Before placing replacement concrete, thoroughly clean edges of existing pavement and wash with neat cement and water.

5. Surface Finish: Wood float finish.

C. Pavement Matching

1. Trim existing asphalt pavements which are to be matched by pavement widening or pavement extension to neat true line with straight vertical edges free from irregularities with saw specifically designed for this purpose. Minimum allowable depth of cut shall be 1-1/2 inches.

2. Cut and trim existing pavement after placement of required aggregate base course and just prior to placement of asphalt concrete for pavement widening or extension, and paint trimmed edges with material for painting asphalt concrete pavement immediately prior to constructing new abutting asphalt concrete pavements. No extra payment will be made for these items and all costs incurred in performing this work shall be incidental to widening or pavement extension.

3.04 FIELD QUALITY CONTROL

A. Inspection:

1. Asphalt Concrete:

a. Lay 10-foot straightedge parallel to centerline of trench when the trenches run parallel to street and across pavement replacement when trench crosses street at angle.

b. Remove and correct any deviation in cut pavement replacement greater than 1/4 inch in 10 feet.

2. Portland Cement Concrete Replacement Pavement:

a. Lay 10 foot straightedge either across pavement replacement or longitudinal with centerline of gutter or ditch.

b. Remove and correct any deviation in cut pavement replacement greater than 1/4 inch in 10 feet.

END OF SECTION

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SECTION 03200
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for concrete, shotcrete, and masonry.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Reinforced Concrete.

1.03 REFERENCE STANDARDS (Editions adopted by current governing California Building Code)

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International.

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International.

D. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International.

E. ASTM A1064 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

F. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

G. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

H. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

I. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

J. AWS D1.4 - Structural Welding Code - Reinforcing Steel; American Welding Society.

K. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute.

1.04 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Shop Drawings (Placing drawings)

1. Comply with requirements of ACI SP-66. Shop drawings must also show details for congested areas and connections. Shop drawings used in field must be reviewed copies.

C. Product Data

1. Manufacturer's catalog sheets including instructions for use and description of application and ICC/IAPMO evaluation report must be provided on each of the following items intended for use on project:

a. Mechanical anchorage devices for splices.

D. Mill Certificates

1. The Contractor must provide Mill Certificates for each size of bar for each heat to be used on project and certify that reinforcing steel supplied for this project meet or exceed specified requirements.

2. Mill Certificates must include name of mill, date of rolling, date of shipping to fabricator and must be signed by fabricator certifying that each material complies with or exceeds the specified requirements. A Mill Certificate must be furnished with each lot of material delivered to the project and the lot must be clearly identified in the Certificate.

3. When Mill Certificates cannot be provided, the Contractor must hire a professional testing laboratory to verify compliance and provide laboratory test reports. The Contractor must pay for the cost of testing.

E. Laboratory Test Reports

1. Laboratory test reports must be signed by a principal of the testing agency who is a registered Civil Engineer in the State of California.

2. When required by other portions of these specifications, laboratory test reports must be submitted for each size of bar tested for each heat to show compliance with appropriate ASTM Standards and these specifications.

F. Welder's Certificates and WPS: Submit description of reinforcement weld locations, welding procedures, and welder certification when welding is permitted.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with the current governing edition of CBC, ACI 301, ACI SP-66, ACI 318, and AWS D1.4 except as modified by the contract documents.

B. Sampling and Testing:

1. General

a. If the Owner's agent, through oversight or otherwise, has accepted material or work which is defective or contrary to specifications, this material or work, regardless of state of completion, may be rejected.

b. Testing agencies must meet the requirements of ASTM E329. Testing agencies must be accepted by the Engineer before performing any work.

2. Testing responsibilities of Contractor:

a. Submit data on qualifications of proposed testing agency for acceptance. Use of testing services will not relieve the Contractor of the responsibility to furnish materials and construction in compliance with the Contract Documents.

b. Cooperate with and notify owner's agent at least 24 hours in advance of inspections required and must provide samples, test pieces, and facilities for inspection at no cost to the owner.

c. Identify each lot of fabricated reinforcing steel to be shipped to the site by assigning an individual lot number that identifies steel by heat number and must be tagged in such a manner that each such lot can be accurately identified at the job site.

d. Remove all unidentified reinforcing steel, anchorage assemblies and bar couplers received at the site.

1.06 STORAGE OF MATERIALS

A. Store reinforcement during fabrication and at site to avoid excessive rusting or coating with grease, oil, soil, or other objectionable materials. Bundles must not be dropped or dragged. Reinforcing steel must be transported and stored in a manner that will not damage any applied coating.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate work with all trades so as not to interfere with the work of other trades. Bring interferences between trades to Engineer's attention and resolve before any concrete is placed.

PART 2 PRODUCTS

2.01 REINFORCING BARS

A. Reinforcing Steel:

1. Bars for reinforcement must conform to the requirements of ASTM A706, deformed low-alloy steel bars for these applications:

a. Horizontal Bars.

b. Vertical Bars.

c. All Reinforcing Bars to be Welded.

ASTM A615, Grade 60 bars may be substituted to meet a through e above if the actual yield strength based on mill tests does not exceed the specified yield strength by more than 18,000 psi, the ratio of the actual ultimate tensile stress to the actual tensile yield strength is not less than 1.25, and the minimum elongation in 8 inches must be at least 14% for #3 through #6, 12% for #7 through #11 and 10% for #14 and #18. This substitution must be verified by the special inspector prior to bundle tag removal.

2. Bars for reinforcement not noted above must be deformed grade steel conforming to the requirements of ASTM A706 or A615, Grade 60.
3. Uncoated steel unless noted otherwise.

2.02 WIRE

A. All wire for concrete reinforcement must conform to ASTM A1064.

2.03 WELDED WIRE REINFORCEMENT

A. All wire fabric mesh must conform to ASTM A185, plain welded wire mesh in flat sheets (not rolls), with welded intersections spaced not farther apart than 12 in. in the direction of principal reinforcement.

B. Use wire-reinforcement supports complying with Class 1, maximum protection, or Class 2, moderate protection, as indicated in Chapter 3 of the CRSI Manual of Standard Practice.

2.04 WELDING ELECTRODES

A. Welding electrodes must be per Table 5-1 of AWS D1.4.

2.05 MECHANICAL COUPLING DEVICES

A. Mechanical coupling devices must develop 125 percent of the minimum yield strength of the bars spliced.

2.06 REINFORCEMENT ACCESSORIES

A. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. Reinforcement supports must conform to the requirements of ACI 301.

2.07 OTHER MATERIALS

A. All other materials, not specifically described by these specifications but required for complete and proper placement of reinforcement must be new, first quality of their respective kinds, and subject to the approval of the Engineer.

2.08 FABRICATION

A. Welding of reinforcement is permitted only with the specific approval of Engineer. Perform welding in accordance with AWS D1.4. Do not weld crossing bars (tack welds) for assembly of reinforcement, supports, or embedded items.

PART 3 EXECUTION

3.01 EXISTING CONDITIONS

A. Prior to all work of the section, carefully inspect the installed work of other trades and verify that all work is sufficiently complete to permit the start of work under this section and that the completed work of this section will be in complete accordance with the original design and the reviewed shop drawings. In the event of discrepancy, immediately notify the Engineer in writing.

B. In the event conduits, pipes, inserts, sleeves, or any other items interfere with placing the reinforcement as indicated on the drawings or approved shop drawings, or as otherwise required, immediately notify the Engineer and obtain approval on procedure before placement of reinforcement is started.

3.02 BENDING

A. Bends for reinforcing steel must be made in accordance with ACI 301 and ACI 318. Bend bar sizes No. 3 through 5 cold only one time, provided reinforcing bar temperature is above 32 degree F. Do not field bend reinforcing steel in a manner that will injure material, cause the bars to be bent on too tight a radius, or that is not indicated as allowed on drawings or permitted by Engineer. Do not straighten bent or kinked bars for use on project without permission of Engineer. Replace bars with kinks or bends not shown on the drawings.

3.03 PLACING

A. All reinforcement must be placed in strict conformance with the requirements of the Contract Drawings, both as to location, position, and spacing of members. It must be supported and secured against displacement by the use of adequate and proper wire supporting and spacing devices, tie wires, etc. so that it will remain in its proper position in the finished structure. Reinforcement may not be wet set in concrete pours.

B. Tolerances: Do not exceed the placing tolerances specified in ACI 318 and ACI 117, whichever is more stringent, before concrete is placed. Placing tolerances must not reduce cover requirements except as specified in ACI 117.

C. Minimum concrete cover for reinforcement and couplers must be as indicated in the Contract Drawings. Concrete cover is measured from the theoretical excavation line, not the line of any over excavation. Where less than 3 inches cover is noted and concrete will be placed against soil, increase the section thickness to attain 3 inches cover.

D. Preserve clear space between parallel bars of not less than 1-1/2 times the nominal diameter of round bars and in no case let the clear distance be less than 1-1/2 inches nor less than 1-1/3 times the maximum size of aggregate for concrete. Bars placed in shotcrete must have a minimum clearance between bars of 2-1/2 inches for No. 5 and smaller and 6 bar diameters for bars larger than No. 5. When two curtains of steel are provided in shotcrete wall, the curtain nearer the nozzle must have a minimum spacing equal to 12 bar diameters and the remaining curtain must have a minimum spacing of six bar diameters.

E. For slabs on ground, extend welded wire reinforcement to within 2 in. of the concrete edge. Reinforcement must be lapped and tied around the perimeter of

each sheet in order to maintain the proper positioning of the reinforcement. Lap splices must have a minimum of two ties per spliced length. Do not place welded wire reinforcement on grade and subsequently raise into position in concrete.

F. Furnish and use templates for placement of column dowels unless otherwise permitted by engineer.

G. Lap splices must be contact lap splices in accordance with ACI 318 unless noted otherwise on the Contract Drawings. Bars must be wired together at laps. Wherever possible, stagger splices in adjacent bars. Splice bars in members such as spandrels, beams, etc., as follows: Top bars at centerline of span, bottom bars at the support. Make all splices in welded wire reinforcement at least 1-1/2 meshes wide or 12 inches, whichever is greater. When splicing in areas to receive shotcrete, lap splices must be non-contact with at least 2 inches clearance between bars.

H. Butt splices must be accomplished by mechanical anchorage devices. Stagger these devices 2 feet, unless noted otherwise on the Contract Documents.

I. Bars must not be cut by gas torch.

3.04 CLEANING REINFORCEMENT

A. Take all means necessary to ensure that steel reinforcement, at the time concrete is placed around it, is completely free from rust, soil, loose mill scale, oil, paint and all coatings which will destroy or reduce the bond between steel and concrete.

END OF SECTION

SECTION 03300
REINFORCED CONCRETE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section. The latest edition of referenced publication in effect at the time of bid opening shall govern.

Reference	Title
American Concrete Institute (ACI)	
ACI 301	Specifications for Structural Concrete for Buildings
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 318/318R	Building Code Requirements for Reinforced Concrete
ACI 347	Formwork for Concrete
American Society for Testing and Materials (ASTM)	
ASTM A615	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C618	Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM D994	Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
Concrete Reinforcing Steel Institute (CRSI)	
	Manual of Standard Practice, 1990, 25th Edition
	Recommended Practice for Placing Reinforcing Bars

1.02 SUBMITTALS

A. Shop Drawings

1. Reinforcing steel in accordance with CRSI 1990 Manual of Standard Practice and ACI SP.
2. Curing compound data.
3. Complete data on the concrete mix, including aggregate gradations and admixtures, in accordance with ASTM C94.
4. Data compiled by a certified Testing Laboratory from a minimum of 30 previous compression tests and 10 previous drying shrinkage tests, for each mix design submitted.
5. Epoxies

B. Quality Control Submittals

1. Manufacturer's application instructions for curing compound.
2. Ready-mix delivery tickets for each truck in accordance with ASTM C94.

C. Mix Designs

1. Mix designs must be submitted for each class of concrete on the job and must show names and brands of all materials, proportions, slump, strength, gradation of coarse and fine aggregates, and location to be used on job. Field test records or test data that is used to establish the average compressive strength of the mixture must be submitted.

D. Certificates of Compliance

1. The Contractor must provide Certificate of Compliance for each type of aggregate, cementitious material and admixture to be used in each class of concrete or a Certificate of Compliance for each class of concrete.
2. Certificates of Compliance for cementitious materials must include type, manufacturing location, shipping location; for aggregates: type, pit or quarry location, producers' name, grading, specific gravities and certification evidence not more than 90 days old; for admixtures: type, brand name, producer, manufacturer's technical data sheet, and certification data; and for water: source of supply that are used in each class of concrete and must be signed by the concrete supplier certifying that each material item complies with, or exceeds the specified requirements. Certificates of Compliance must be furnished 60 days in advance of any concrete pours.
3. When Certificates of Compliance cannot be provided, the Contractor must hire a professional testing laboratory to verify compliance of each type of material to be used in each Class of Concrete. The cost of testing must be paid for by the Contractor.
4. The Contractor must provide a certificate of compliance for the vapor retarder/barrier material. When a Certificate of Compliance cannot be provided, laboratory test reports must be provided. The cost of testing must be paid for by the Contractor.

5. Certificates of Compliance for vapor retarder/barrier must include the name, and description of the product and must state that the product complies with ASTM E1745 and ASTM E154.

E. Weight and Batch Tags:

1. The special inspector must be provided with a weight and batch tag upon delivery of each load of concrete. The batch tag must show weight of all materials.

1.03 QUALITY ASSURANCE

A. Codes and Standards

1. Comply with all Federal, State and Local Codes and Safety Regulations. In addition, comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified.
2. California Building Code, 2013 Edition, CBC.
3. Formwork: Unless otherwise specified, follow the recommendations of ACI 347.
4. Concrete and Reinforcement: Unless otherwise specified, meet the requirements of ACI 301 and 318/318R.
5. Hot Weather Concreting: Conform to ACI 305R.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not use curing compound where solvents in the curing compounds are prohibited by state or federal air quality laws. Use only water curing methods.

PART 2 PRODUCTS

2.01 CONCRETE

A. Ready-mixed meeting ASTM C94, Option A.

B. Portland Cement: ASTM C150, Type II.

C. Fly Ash: ASTM C618, Class F.

1. Fly ash may substitute for portland cement up to a maximum of 25% of total cementitious materials by weight (fly ash, if used, must substitute for 15% of the total cementitious materials by weight, minimum).

a. Substitutions that combine fly ash and ground granulated blast-furnace slag are limited to a combined total of 50% of the total cementitious material by weight with fly ash no more than 25% of the total cementitious materials by weight.

b. Reduce slag and fly ash substitution rates by at least 50% for cold weather concreting as defined in ACI 306.1.

D. Aggregates: Furnish from one source.

1. Natural Aggregates

a. Free from deleterious coatings and substances in accordance with ASTM C33, except as modified herein.

b. Free of materials and aggregate types causing pop outs, discoloration, staining, or other defects on surface of concrete.

2. Non-Potentially Reactive: In accordance with ASTM C33, Appendix XI, paragraph X1.1.

3. Aggregate Soundness: Test for fine and coarse aggregates in accordance with ASTM C33 and ASTM C88 using sodium sulfate solution.

4. Fine Aggregates

a. Clean, sharp, natural sand.

b. ASTM C33.

c. Materials Passing 200 Sieve: 4 percent maximum.

d. Limit deleterious substances in accordance with ASTM C33, Table 1 with material finer than 200 sieve limited to three percent, coal and lignite limited to 0.5 percent.

5. 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. Materials Passing 200 Sieve: 0.5 percent maximum.

E. Admixtures

1. Air-Entraining: ASTM C260.

2. Water-Reducing: ASTM C494, Type A or D.

3. Superplasticizers: ASTM C494, Type F or G.

4. Fly Ash: ASTM C618, Class C or F.

F. Coloring

1. All concrete with exposed surfaces (such as equipment and access pads, sidewalks, curb and gutter, driveways, and catch basins) shall be colored by adding 1.5 pounds of Lamp Black per cubic yard of Concrete.

G. Mix Design

1. Minimum 28-day Compressive Strength when cured and tested in accordance with ASTM C31 and C39.

a. Equipment Pads, Access Pads and SCADA Pole Foundations: 4,000 psi

b. Miscellaneous Site Concrete: 3,000 psi

2. Coarse Aggregate Size: 1½ inches and smaller.

3. Slump Range: three to five inches.

4. Air Entrainment: Between one and three percent by volume.

5. Water Reducers: Use in concrete without plasticizers.

H. Proportions

1. Design mix to meet aesthetic and structural concrete requirements.

2. Water-cement ratio (or water-cement plus fly ash ratio) shall control amount of total water added to concrete as follows:

Mix Strength	W/C Ratio
4,000psi	0.55(Non-Air Entrained)
	0.48 (Air Entrained)
3,000psi	0.55(Non-Air Entrained)
	0.55 (Air Entrained)

3. Minimum Cement Content (or Combined Cement Plus Fly Ash Content When Fly Ash is Used):

a. 540 pounds per cubic yard for concrete with 1½-inch maximum size aggregate.

b. 564 pounds per cubic yard for one-inch maximum size aggregate.

4. Increase cement content or combined cement plus fly ash content, as required to meet strength requirements and water-cement ratio.

I. Mixing: Minimum 70 and maximum 270 revolutions of mixing drum. Non-agitating equipment is not allowed.

2.02 REINFORCING STEEL

A. Deformed Bars: ASTM A615, Grade 60. Reinforcing steel to be welded shall be ASTM A706, Grade 60.

B. Welded Wire Fabric: ASTM A497.

2.03 ANCILLARY MATERIALS

A. Cast-in-Place Anchor Bolts, Adhesive Anchor Bolts, Expansion Anchors: see Section 05501 – Anchor Bolts.

B. Expansion Joint Filler: ASTM D994, ½ inch thick, or as shown.

C. Bonding Compounds

1. Epoxy resin bonding compounds shall be used for wet areas and shall be Master Builder, Concresive Nos. 1001, 1001-LPL or 1180 as applicable;

Sika Chemical Corporation, Sikadur 35, Hi-Mod LV, Sikadur 32, Hi-Mod, or Sikadur 31, Hi-Mod Gel as applicable; Burke Company 881 LPL Epoxy; or equal.

2. Non-epoxy bonding compounds shall be used for dry areas and shall be Burke Company, Acrylic Bondcrete; Imperial Chemical Industrial, Inc., Thoro System Products, Acryl 60; Thorobond; or equal. Bonding compounds shall be applied in accordance with the manufacturer's instructions.

D. Curing Compound

1. Material: Solvent based containing chlorinated rubber solids in accordance with ASTM C309, with additional requirement that the moisture loss not exceed 0.030 gram per centimeter squared per 72 hours.

2. Manufacturers and Products:

a. Chemrex Inc., Shakopee, MN; Masterkure CR.

b. Euclid Chemical Co.; Euco Super Floor Coat.

E. Surface Hardener

1. Surface hardener shall be premixed, noncolored, nonmetallic Master Builders, Mastercron; Sonneborn, Harcol; A. C. Horn Inc., Durafax; Burke Company Non-Metallic Floor Hardner; or equal. Surface hardener shall be applied in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.01 FORMWORK

A. Form Materials

1. Use hard plastic finished plywood for exposed areas, and new ship lap or plywood for unexposed areas.

2. Earth cuts may be used for forming footings.

B. Form Ties

1. Fixed conical or spherical type inserts that remain in contact with forming material and allow for dry packing of form tie holes.

2. Ties shall withstand pressures and limit deflection of forms to acceptable limits.

3. Wire ties are not acceptable.

C. Construction

1. In accordance with ACI 347.

2. Make joints tight to prevent escape of mortar and to avoid formation of fins.

3. Brace as required to prevent distortion during concrete placement.

4. On exposed surfaces locate form ties in uniform pattern or as shown.
5. Construct so ties remain embedded in the wall with no metal within 1-inch of concrete surface when forms, inserts, and tie ends are removed.

D. Form Removal

1. Remove after concrete has attained 28-day strength, or approval is obtained in writing from Engineer.
2. Remove forms with care to prevent scarring and damaging the surface.

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. Top Bars: Horizontal bars placed such that 12 inches of fresh concrete is cast below in single placement.
2. Horizontal wall bars are considered top bars.
3. All bar lap splices shall be Class B in accordance with ACI 318.
4. Tie splices with 18-gauge annealed wire as specified in CRSI Standard.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Prior to placing concrete, remove water from excavation and debris and foreign material from forms. Check reinforcing steel for proper placement and correct discrepancies.

C. Before depositing new concrete on old concrete, clean surface using sandblast or bush hammer or other mechanical means to obtain a ¼ inch rough profile, and pour a cement-sand grout to minimum depth of ½ inch over the surface. Proportion 1 part cement to 2.5 parts sand by weight.

D. 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 two feet deep. Place within 1½ hours after adding cement to mix.

E. Eight feet maximum vertical drop to final placement, when not guided with chutes or other devices to prevent segregation due to impact with reinforcing.

F. Hot Weather

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 305R.
2. Maintain concrete temperature below 80 degrees F at time of placement, or furnish test data or provide other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking due to

heat of hydration. Ingredients may be cooled before mixing to maintain fresh concrete temperatures at 80 degrees F or less.

3. Make provisions for windbreaks, shading, fog spraying, sprinkling, ice, or wet cover, or other means to provide concrete with temperature specified.

4. Prevent differential temperature between reinforcing steel and concrete.

3.04 COMPACTION

A. Vibrate concrete as follows:

1. Apply approved vibrator at points spaced not farther apart than vibrator's effective radius.

2. Apply close enough to forms to vibrate surface effectively but not damage form surfaces.

3. Vibrate until concrete becomes uniformly plastic.

4. Vibrator must penetrate fresh placed concrete and into previous layer of fresh concrete below.

3.05 CONSTRUCTION JOINTS

A. Locate as shown or as approved.

B. Maximum Spacing Between Construction Joints: 40 feet.

3.06 FINISHING

A. Floor Slabs and Tops of Walls

1. Screed surfaces to true level planes.

2. After initial water has been absorbed, float with wood float and trowel with steel trowel to smooth finish free from trowel marks.

3. Do not absorb wet spots with neat cement.

B. Unexposed Slab Surfaces: Screed to true surface, bull float with wood float, and wood trowel to seal surface.

C. Smooth Wall Finish

1. Patch tie holes.

2. Grind off projections, fins, and rough spots.

3. Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.

D. Tolerances: Floors shall not vary from level or true plane more than ¼ inch in 10 feet when measured with a straightedge.

E. Exterior Slabs and Sidewalks

1. Bull float with wood float, wood trowel, and lightly trowel with steel trowel.

2. Finish with broom to obtain nonskid surface.
3. Finish exposed edges with steel edging tool.
4. Mark walks transversely at 5-foot intervals with jointing tool.

3.07 FINISHING AND PATCHING FORMED SURFACES

A. Cut out honeycombed and defective areas.

B. Cut edges perpendicular to surface at least one-inch deep. Do not feather edges. Soak area with water for 24 hours.

C. Finish surfaces to match adjacent concrete.

D. Keep patches damp for minimum 7 days or spray with curing compound to minimize shrinking.

E. Fill form tie holes with non-shrink, non-metallic grout.

3.08 PROTECTION AND CURING

A. Protect fresh concrete from direct rays of sunlight, drying winds, and wash by rain.

B. Keep concrete slabs continuously wet for a seven-day period. Intermittent wetting is not acceptable.

C. Use curing compound only where approved by Engineer. Cure formed surfaces with curing compound applied in accordance with manufacturer's directions as soon as forms are removed and finishing is completed.

D. Remove and replace concrete damaged by freezing.

3.09 FIELD QUALITY CONTROL

A. Provide adequate facilities for safe storage and proper curing of concrete test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

B. Provide concrete for testing of slump, air content, and for making cylinders from the point of discharge into forms.

C. Evaluation will be in accordance with ACI 301, Chapter 17 and Specifications.

D. Specimens will be made daily, cured, and tested in accordance with ASTM C31 and ASTM C39.

E. The City (or the City’s Representative) will prepare test cylinders daily during concrete placement. Frequency of testing may be changed at discretion of Engineer.

F. Reject concrete represented by cylinders failing to meet the strength and air content specified.

END OF SECTION

SECTION 03400
PRECAST CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Precast concrete wetwells, vaults, precast electrical pull boxes, and joint sealers.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. C 150 - Specification for Portland Cement.
2. C 478 - Precast Reinforced Concrete Manhole Sections
3. C 858 - Underground Precast Concrete Utility Structures.
4. C 913 - Precast Concrete Water/Wastewater Structures.

1.03 SUBMITTALS

A. Precast Concrete

1. Concrete Mix design and data.
2. Design Calculations stamped and signed by a California licensed Civil or Structural Engineer (shall be in conformance with the project geotechnical report and the specifications herein).
3. Shop drawings showing dimensions, reinforcement, connections, etc.
4. Design load calculations signed by a California licensed Civil or Structural engineer.

B. Quality Control Submittals

1. Manufacturer's application instructions for curing compound.
2. Ready-mix delivery tickets for each truck in accordance with ASTM C94.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE STRUCTURES

A. Where shown on the plans, the Contractor may use reinforced concrete structures that are cast at an off-site location. In general these structures include vaults and electrical pull boxes. Precast concrete structures shall conform to ASTM C478, C858 and C913.

B. All precast concrete structures will be manufactured in a plant especially designed for that purpose. Standard products may be used wherever feasible.

C. All precast concrete structures shall be H20 rated and certified for continuous street loading, unless otherwise specified on the plans.

D. Design of precast concrete structures is the responsibility of the Contractor and Contractor's Engineer. Design Calculations shall be stamped and signed by a California licensed Civil or Structural Engineer. Design requirements are listed below:

1. Structures shall be designed to resist buoyant forces from groundwater assuming a depth of groundwater at finish grade.
2. Design loads shall consist of dead load, live load, impact load, full depth interior fluid, loads due to groundwater table at finish grade, seismic loads, and any other loads which may be imposed on the structure. Soil properties and loading values detailed in the project geotechnical report shall be used for the design of precast concrete structures.
    a. The precast concrete vault for the Golf Course Pump Station Control panel shall be designed to resist buoyant forces assuming the area is flooded with water to the top of the vault. The vault will be filled with crushed rock as shown on the Plans.
3. Wet Well – The bottom 3 feet of the wall riser shall be cast integrally with the bottom slab to eliminate a joint at the wall to base interface.
4. Individual riser sections shall be designed to utilize as few joints as possible. Vertical joints are not allowed.
5. Precast structures shall be designed to be water tight and to limit movement and deflections.

E. All precast concrete structures shall be manufactured in a plant especially designed for that purpose. Standard products may be used wherever feasible.

F. The Contractor shall submit shop drawings showing reinforcement, connections, embedded items, etc. Pipe penetrations shall be formed or core drilled. Penetrations 4 inches in diameter or larger shall be formed at the precast concrete plant.

G. Hatches for precast structures shall be installed at the precast concrete plant. The size and position of hatches shall be as shown on the Plans. The hatches shall be as specified in Section 08310.

2.02 MATERIALS

A. Concrete shall be meet the requirements of Section 03300.

B. Reinforcing steel shall conform to Section 03200.

2.03 JOINT SEALERS

A. All joints between precast concrete sections shall be made water-tight by using a preformed plastic material that is permanently self-adhering and flexible. Compound shall be "Ram-Nek" as manufactured by K.T. Snyder Company,

Houston, Texas or approved equal. (“Ram-Nek” is distributed locally by Hanson Concrete Products of Milpitas.) Follow manufacturer’s recommended installation procedures.

B. Where cast-in-place concrete is poured against an existing concrete structure, a pre-formed rubber hydrophilic water stop with adhesive back shall be installed on the precast side of the joint prior to the pour. Water stop shall be Adeka Ultra Seal MC-2010M or equivalent. Follow manufacturer’s recommended installation procedures.

2.04 NON-SHRINK GROUT

A. Grout shall meet the requirements of Section 03600.

PART 3 EXECUTION

3.01 CASTING

A. Precast concrete structures shall be cured at the plant following manufacturer’s procedures. Structures shall not be shipped to the site until fully cured.

3.02 STORAGE, HANDLING AND DELIVERY

A. Precast structures shall be fully braced (with temporary struts if necessary) until the structures have been delivered to the project site, installed, leveled and anchored into place as shown on the plans.

B. After cure, structures may be stored on the project site at the Contractor’s own risk. Contractor is responsible for coordinating the delivery of precast concrete structures, and all trades required for their installation and anchorage

3.03 INSTALLATION

A. Precast concrete structures shall be installed as shown on the plans, according to manufacturer’s recommendations.

B. Joint sealers shall be used as specified herein for a water-tight installation.

3.04 DEFECTIVE CONCRETE AND REPAIRS

A. Concrete shall be considered defective for the following reasons:

1. Failure of finished concrete profiles to conform to the plans within tolerance.
2. Failure to meet the specified cylinder strength requirements.
3. Concrete showing cracks, rock pockets, voids, spalls, or defects that adversely affect the structural adequacy of the concrete.

B. Defective concrete that results from improper casting or curing shall be repaired or replaced at the plant prior to shipment; damaged concrete that results from

transportation, handling, or storage after the piece leaves the plant shall be repaired or replaced at no expense to the City.

C. Repairing and Patching: Immediately after removing forms, all concrete surfaces shall be inspected and any pour joints, voids, rock pockets, tie holes, except as specified, etc., shall be patched at once. Defective areas shall be chipped away to a depth of about one inch with the edges perpendicular to the surface

END OF SECTION

SECTION 03600
GROUT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete mortar.
2. Grout.
3. Drypack mortar.
4. Nonshrink grout.
5. Epoxy grout.
6. Non-shrink epoxy grout.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2 inch or 50 millimeter cube specimens).
2. C531 - Test Method for Liner Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
3. C579 - Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings.
4. C827 - Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
5. C939 - Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
6. C1090 - Test Method for Measuring Change in Height of Cylindrical Specimens from Hydraulic-Cement Grout.
7. C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
8. C1181 - Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

1.03 SUBMITTALS

A. Nonshrink Grout and Non-shrink Epoxy Grout: Submit manufacturer's literature and certified test data prior to installation.

1.04 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to the jobsite in their original, unopened packages or containers, clearly labeled with the manufacturer's product identification and printed instructions.

B. All materials shall be stored in a cool dry place and in accordance with the manufacturer's recommendations.

C. All materials shall be handled in accordance with the manufacturer's instructions.

1.05 PROJECT/SITE CONDITIONS

A. Refer to manufacturer's literature or contact the manufacturer for any special physical or environmental limitations that may be required for use of products.

1.06 WARRANTIES

A. Non-shrink Grout: The manufacturer shall warranty that the non-shrink grout will never go below its initial placement volume when tested in accordance with ASTM C1107.

B. Non-shrink Epoxy Grout: The manufacturer shall warranty that non-shrink epoxy grout will show negligible shrinkage or expansion when tested in accordance with ASTM C531.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete Mortar:

1. General: Consist of concrete mixture with coarse aggregate removed and water quantity adjusted as required.
2. At Exposed Concrete Surfaces Not to Be Painted or Submerged in Water: White cement.

B. Grout:

1. Consist of mixture of Portland cement and sand.

C. Dry-pack Mortar:

1. Consist of mixture of Portland cement and sand.

D. Non-shrink Grout:

1. Non-shrink grout shall be a preportioned and prepackaged cement-based mixture. It shall contain no metallic particles such as aluminum powder and no metallic aggregate such as iron filings. It shall require only the addition of potable water.

2. Potable water for pre-soaking, mixing, and curing shall be clean and free of oils, acids, alkalies, organics, and any other deleterious matter.

3. Bleeding: Non-shrink grout shall be free from the emergence of mixing water from within or the presence of water on its surface.

4. Non-shrink grout shall be in accordance with ASTM C1107.

5. Consistency: Non-shrink grout shall remain at a minimum flowable consistency for at least 45 minutes after mixing at 45 degrees Fahrenheit to 90 degrees Fahrenheit when tested in accordance with ASTM C230. If at a fluid consistency, it shall be verified in accordance with ASTM C939.

6. Dimensional Stability (height change): Non-shrink grout shall be in accordance with ASTM C1107, volume-adjusting Grade B or C at 45 degrees to 90 degrees. It shall show 90 percent or greater bearing area under bases or baseplates.

7. Compressive Strength: Non-shrink grout shall show minimum compressive strengths at 45 degrees Fahrenheit to 90 degrees Fahrenheit in accordance with ASTM C1107 for various periods from the time of placement, including 5,000 pounds per square inch at 28 days when tested in accordance with ASTM C109 as modified by C1107.

8. Manufacturers: One of the following or equal:

   a. Simpson Strong-Tie Company Inc., Pleasanton, CA, FX-228.

   b. Five Star Products, Inc., Fairfield, CT, Five Star Grout.

   c. Master Builders, Inc., Cleveland, OH, Masterflow 928.

   d. L&M Construction Chemicals, Inc., Omaha, NE, CRYSTEX.

E. Epoxy Grout:

1. Consist of mixture of epoxy and sand.

2. Sand: Clean, bagged, graded, and kiln dried silica sand.

F. Non-shrink Epoxy Grout:

1. Non-shrink epoxy grout shall be a 100 percent solids, premeasured, prepackaged system containing a two-component thermosetting epoxy resin and inert aggregate.

2. Consistency: Non-shrink epoxy grout shall maintain a flowable consistency for at least 45 minutes at 70 degrees Fahrenheit.

3. Dimensional Stability (height change):

   a. Non-shrink epoxy grout shall have negligible shrinkage or expansion (less than 0.0006 in/in) when tested in accordance with ASTM C531.

4. Compressive Strength: Non-shrink epoxy grout shall show a minimum compressive strength of 10,000 pounds per square inch at 24 hours and 14,000 pounds per square inch at 7 days when tested in accordance with ASTM C579, Method B.

5. Compressive Creep: The compressive creep for non-shrink epoxy grout shall not exceed 0.0027 in/in when tested under a 400 pounds per square inch constant load at 140 degrees Fahrenheit in accordance with ASTM C1181.
6. Thermal Capability: The coefficient of thermal expansion for non-shrink epoxy grout shall not exceed 0.000018 inches per inch per degree Fahrenheit when tested under ASTM C531, Method B.
7. Manufacturers: One of the following or equal:
    a. Simpson Strong-Tie Company Inc., Pleasanton, CA, FX-1200.
    b. Five Star Products, Inc., Fairfield, CT, Five Star Epoxy Grout.
    c. Master Builders, Inc., Cleveland, OH, Masterflow 648 CP Plus.
    d. L&M Construction Chemicals, Inc., EPOGROUT.

2.02 MIXES

A. Concrete Mortar Mix:
1. Use water-cement ratio that is no more than that specified for concrete being repaired.
2. At Exposed Concrete Surfaces Not to Be Painted or Submerged in Water: Use sufficient white cement to make color of finished patch match that of surrounding concrete.

B. Grout Mix:
1. For Concrete Repair: Mix in same proportions used for concrete being repaired, with only sufficient water to give required consistency for spreading.
2. For Spreading over the Surfaces of Construction or Cold Joints: Mix with no more water used than allowed by water-cement ratio specified for concrete.
3. For Other Applications: Mix in proportions by weight of one part cement to four parts of concrete sand.

C. Dry-pack Mortar Mix: Use only enough water so that resulting mortar will crumble to touch after being formed into ball by hand.

D. Non-shrink Grout: Mix in accordance with manufacturer's installation instructions such that resulting mix has fluid or flowable consistency and is suitable for placing by pouring.

E. Epoxy Grout:
1. Mix in accordance with manufacturer's installation instructions for mixing.
2. Proportioning:
    a. For horizontal work, consist of mixture of one part epoxy as specified in Section 03071 with not more than 2 parts sand.

b. For vertical or overhead work, consist of 1 part epoxy gel as specified in Section 03071 with not more than 2 parts sand.

F. Non-shrink Epoxy Grout: Mix in accordance with manufacturer's installation instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect concrete surfaces to receive grout or mortar and verify that they are free of ice, frost, dirt, grease, oil, curing compounds, paints, impregnations and all loose material or foreign matter likely to affect the bond or performance of grout or mortar.

B. Inspect baseplate and anchor systems for rust, oil, and other deleterious substances that may affect the bond or performance of grout.

C. Confirm that newly placed concrete has been cured sufficiently to attain its design strength and limit further shrinkage.

D. Verify that temperature of cementitious or epoxy grout does not exceed manufacturer's recommendations.

3.02 PREPARATION

A. Surface Preparation:

1. Roughen all concrete surfaces by heavy sandblasting, chipping, or other mechanical means to assure bond. Loose or broken concrete shall be removed.

2. All grease, oil, dirt, curing compounds, laitance, and other deleterious materials that may affect bond that were identified in the inspection process shall be completely removed from concrete and bottoms of baseplates. All metal surfaces should have a 2 to 3 mil peak-to-valley profile for epoxy grouts.

3. For cementitious mortars and grouts, concrete surfaces shall be saturated surface dry. Any standing water shall be removed prior to placing grouts.

4. For epoxy grouts, do not wet concrete surfaces with water. Instead, where required, wet surfaces with epoxy for horizontal work or epoxy gel for vertical or overhead work prior to placing epoxy grouts.

B. Forms and Headboxes for Grouts (Cementitious or Epoxy):

1. Forms for grouts shall be built of material with adequate strength to withstand the placement of grouts.

2. Forms must be rigid and liquid tight. All cracks and joints shall be caulked with an elastomeric sealant. All forms shall be lined with polyethylene for

easy grout release. Forms carefully waxed with two coats of heavy-duty paste wax shall also be acceptable.

3. Forms shall be 4 to 6 inches higher than the baseplate on one side of the baseplate configuration when using head pressure for placement.
4. A sufficient number of headboxes shall be built to facilitate placement of grouts.
5. Air relief holes a minimum 1/8 inch in diameter shall be provided when required by a baseplate configuration to avoid entrapping air underneath.

3.03 APPLICATION

A. Cement Mortar and Grout:

1. For Defective Concrete Repair:
   a. Filling: Filling of voids around items through the concrete.
   b. Grout Spreading: Spread over construction joints, cold joints, and similar type items.
2. Concrete Surfaces:
   a. Apply epoxy bonding agent to clean, roughened, and dry surfaces before placing mortar or grout.
3. Placing:
   a. Exercise particular care in placing Portland cement mortar or grout since they are required to furnish structural strength or impermeable water seal or both.
   b. Do not use cement mortar or grout that has not been placed within 30 minutes after mixing.

B. Epoxy Grout:

1. Apply in accordance with manufacturer's installation instructions.
2. Use where specified herein or where indicated on the Plans.

3.04 PLACEMENT

A. The Contractor shall make arrangements to have a grout manufacturer's representative present for a preconstruction meeting and during initial grout placement. Grout shall only be installed after the final equipment alignment is correct and accepted by the Engineer.

1. Grouts shall be mixed in accordance with the manufacturer's recommendations.
2. A mortar mixer with moving paddles shall be used for mixing grouts. For cementitious grouts, pre-wet the mixer and empty out excess water before beginning mixing.

3. Cementitious Grouts:

    a. Non-shrink cementitious grout shall be added to a premeasured amount of water that does not exceed the manufacturer's maximum recommended water content.

    b. Mix cementitious grouts per manufacturer's instructions for uniform consistency.

    c. Grouts may be drypacked, flowed, or pumped into place. All baseplate grouting shall take place from one side of a baseplate to the other to avoid trapping air. Do not overwork grouts.

    d. Do not retemper grout by adding more water after stiffening.

    e. Hydrostatic head pressure shall be maintained by keeping the level of the grout in the headbox above the bottom of the baseplate. The headbox should be filled to the maximum level and the grout worked down to top of baseplate.

4. Epoxy Grouts:

    a. Epoxy grouts shall be mixed in complete units. Do not vary the ratio of components or add solvent to change the consistency of the mix.

    b. Pour the hardener into the resin and mix for at least one minute and until each mixture is uniform in color. Pour the chemical components into the mortar mixer wheelbarrow and add the aggregate. Mix until aggregate is uniformly wetted. Overmixing will cause air entrapment in the mix.

    c. All epoxy grout shall be flowed into place using a headbox. All grouting shall take place from one side of a baseplate to the other in a continuous flow to avoid trapping air.

    d. Hydrostatic head pressure shall be maintained by keeping the level of grout in headboxes above the bottom of baseplates. Headboxes shall be filled to the maximum level and grout worked down to the bottom of baseplates.

    e. Epoxy grouts shall not be cut back after setting. The final level of grout will be as installed with all chamfer edges built into the formwork.

3.05 CURING

A. Cementitious Grouts:

1. Grouts must be cut back to the lower edge of baseplates after reaching initial set. Provide a 45 degree angle cut back.

2. Clean equipment and tools as recommended by the grout manufacturer.

3. Cure Grouts in accordance with manufacturer's specifications and recommendations. Keep grout moist for a minimum of 3 days. The method needed to protect grouts will depend on temperature, humidity, and wind. Wet burlap, a soaker hose, sun shading, ponding and, in extreme conditions, a combination of methods shall be employed.

4. Grouts shall be maintained above 40 degrees Fahrenheit until they have attained a compressive strength of 3,000 pounds per square inch or above 70 degrees Fahrenheit for a minimum of 24 hours to avoid damage from subsequent freezing.

B. Epoxy Grouts:

1. Cure grouts in accordance with manufacturers' specifications and recommendations. Do not wet cure epoxy grouts.

2. Consult the manufacturer for appropriate cure schedule. In no case should any surface in contact with grout be allowed to fall below 50 degrees Fahrenheit for a minimum of 48 hours after placement.

3. Equipment and tools shall be cleaned immediately with a strong liquid detergent and water solution before grout hardens.

3.06 FIELD QUALITY CONTROL

A. Non-shrink cementitious grouts shall be tested for 24 hour compressive strength in accordance with ASTM C109.

B. Non-shrink grouts shall be tested for 24 hour compressive strength in accordance with ASTM C579 (Method B).

END OF SECTION

SECTION 05501
ANCHOR BOLTS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies anchor bolts, adhesive anchoring systems, expansion anchors, and cast-in-place inserts, complete with washers and nuts. Unless otherwise specified, anchor bolts shall be Type 316 stainless steel.

1.02 RELATED REQUIREMENTS

A. Section 03100 – Concrete Forming and Accessories

B. Section 03200 – Concrete Reinforcing

1.03 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. The latest edition of referenced publications in effect at the time of bid opening shall govern. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM A36/A36M	Carbon Structural Steel
ASTM A307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A320/A320M	Alloy Steel Bolting Materials for Low-Temperature Service for Pressure and High-Temperature Parts
ASTM A449	Quenched and Tempered Steel Bolts and Studs
CBC	2013 California Building Code

1.04 SUBMITTALS

A. Submittals shall be provided in accordance with Section 01300 – Submittals and shall include the following information:

1. Data indicating load capacities.
2. Chemical resistance.
3. Temperature limitations.
4. Installation instructions.
5. Evaluation Report for expansion type anchors as specified in Paragraph 05501-3.04.
6. Design calculations in accordance with Paragraph 05501-2.03.
7. Manufacturer’s data and catalog numbers.

PART 2 PRODUCTS

2.01 GENERAL

A. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 25 percent up to a limiting maximum oversizing of 1/8-inch. Minimum anchor bolt diameter shall be ½-inch.

B. Tapered washers shall be provided where mating surface is not square with the nut.

C. Expansion or adhesive anchors set in holes drilled in concrete after the concrete is placed will not be permitted in substitution for cast-in-place anchor bolts except where otherwise specified. Upset threads shall not be acceptable.

2.02 MATERIALS

A. Anchor bolt materials shall be as specified in Table A unless otherwise specified. All equipment anchor bolts and anchor bolts that are submerged or above the water surface shall be Type 316 stainless steel.

Table A. Anchor Bolt Materials

Material	Specification
Carbon steel bolts: Structures Equipment	 ASTM A307, hot-dip galvanized, Grade A ASTM A449, Type 1, hot-dip galvanized
Stainless steel bolts, nuts, washers	ASTM A320 Type 304 or 316
Expansion anchors	Simpson Strong-Bolt 2, Hilti Kwik Bolt TZ, or equal
Adhesive anchor bolts	Simpson SET-XP, Hilti HIT-RE 500-SD, or equal

B. Adhesive anchoring system

1. Adhesive anchoring system in concrete must be SET-XP (ESR-2508) or approved equal with a current ICC/IAPMO evaluation report.

C. Expansion anchors

1. Expansion anchors must be CS STRONG BOLT-2 (ESR-1771) by SIMPSON or approved equal with a current ICC/IAPMO evaluation report.

D. Inserts with ASTM A36 threaded rod

1. Dewalt Snake+ (ESR-2272) with ASTM A36 threaded rod
2. HILTI HIS-N Inserts (ESR-3187) with ASTM A325 bolts.
3. HILTI HIS-RN Inserts (ESR-3187) with ASTM A193 Grade B8M stainless steel bolts.

2.03 DESIGN

A. Anchor bolts for equipment frames and foundations shall be designed in accordance with Section 01610 – Seismic Design Criteria. Seismic forces shall

be considered acting at the center of gravity of the piece under consideration. Additionally, if wind loading is applicable, a basic wind speed of 115 miles per hour, Exposure Category C, and an Importance Factor of 1.00 shall be used.

B. Calculations and shop drawings shall be submitted with the equipment submittal in accordance with Paragraph 05501-1.04 and Section 01300 - Submittals for all anchorage details. All calculations shall be prepared and signed by a civil or structural Professional Engineer licensed to practice in the state where the Project is located.

C. Equipment that requires anchorage design includes:

1. Control panels
2. Service Pedestals

PART 3 EXECUTION

3.01 GENERAL

A. Fieldwork, including cutting and threading, shall not be permitted on galvanized items. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators. All stainless steel anchor bolts and fasteners shall be assembled with a stainless steel anti-seize compound such as molycote.

B. Anchor minimum edge distances defined by the current ICC/IAPMO evaluation report must be met at edges, control joints and cracks greater than 0.015 inches wide. Installation of anchors and adhesive including drilling, cleaning of holes and torque must be in accordance with the current ICC/IAPMO evaluation report. Verify whether the evaluation report requires a maximum or minimum torque. Confirm torque with a torque wrench calibrated to the inspector's torque wrench. Post installed anchors must be used only in applications permitted by the Evaluation Report. Anchors must use washer sized to prevent crushing of the attached member at installation torque.

C. Provide stainless steel anchors for exterior use or when expose to weather or in chemically corrosive environments. Provide galvanized carbon steel anchors at other locations unless noted otherwise on the Drawings.

D. If reinforcement is encountered during drilling, abandon and shift the hole location to avoid the reinforcement. Provide a minimum of 2 anchor diameters or 1 inch, whichever is larger, of sound concrete between the anchor and the abandoned hole. Fill the abandoned hole with non-shrink grout. If the anchor or dowel may not be shifted as noted above, the Engineer will determine a new location.

3.02 CAST-IN-PLACE ANCHOR BOLTS

A. Anchor bolts to be embedded in concrete and concrete unit masonry shall be placed accurately and held in the correct position while the concrete or grout is placed or, if specified, recesses or blockouts shall be formed in the concrete and the metalwork shall be grouted in place in accordance with Section 03300 –

Cast-in-Place Concrete. The surfaces of metalwork in contact with concrete shall be thoroughly cleaned.

B. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.

3.03 ADHESIVE ANCHORS

A. Insert the anchor or dowel in the hole with a twisting motion to the required embedment depth. Do not pump the anchor or dowel in and out of the hole.

B. Wedge bars tight and centered in the hole with wooden wedges (golf tees) to hold it in place until the adhesive sets.

3.04 EXPANSION ANCHORS AND SCREW ANCHORS

A. Install per the ICC/IAPMO report to the nominal embedment depth shown on the plans. Tightening of expansion anchors must not reduce the embedment below that specified on the plans by more than eight threads. Projecting portions of expansion anchors must not be cut off before inspection is complete.

END OF SECTION

SECTION 08310
ACCESS DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Access doors.

1.02 SUBMITTALS

A. Product Data.

B. Shop Drawings: Show the following:

1. Access door attachment to structure in each typical condition.
2. Locations of access doors.
3. Detailed drawings showing all dimensions and materials.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Identify type and size of each door in way not to damage finish prior to delivery.

B. Deliver products only after proper facilities are available.

C. Deliver and store packaged products in original containers with seals unbroken and labels intact until time of use.

D. Handle carefully to prevent damage and store on clean concrete surface or raised platform in safe, dry area. Do not dump onto ground.

E. Protect access doors during shipment and storage to prevent warping, bending, and corrosion.

PART 2 PRODUCTS

2.01 FLOOR HATCHES

A. **H20 Rated Access Hatches:**

1. H20 Rated Access Hatches shall be designed for unintended H-20 loading conditions.
2. Access hatch shall be manufactured by EJ, Style CHS – Heavy Duty H-20 Rated SAFE HATCH, or approved equal.
3. Channel frame shall be extruded aluminum, to match the hatch material, cast into the new concrete structure. A continuous EPDM gasket shall be mechanically attached to the aluminum frame to create a gastight barrier

around the entire perimeter of the cover and eliminate dirt and debris that may enter the channel frame.

4. Hinges: Heavy forged aluminum hinges, each having a minimum 1/4" (6.3 mm) diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame. Shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamper-proof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.
5. Recessed Padlock Clip: Hatch shall have a recessed padlock compartment and padlocks. The recessed padlock clip shall be supplied with its own separate hinged cover for access. The separate hinged cover shall be supplied with a spring-loaded cover so that there is no possibility of the cover being left in the “open” position, which would cause a tripping hazard.
6. Lift Handle: Hatch shall have cast stainless steel lift handles, flush with the top surface of the hatch.
7. Hatches shall be designed for easy opening by one person from both inside and outside and shall be balanced to require no more than 30 lbs. of opening force.
8. Lifting Mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" gusset support plate.
9. Cover shall be equipped with a hold open arm which automatically locks the cover in the open position. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
10. Hardware shall be anticorrosion throughout. Factory finish shall be **anodized aluminum** with bituminous coating applied to the exterior of the frame.
11. If necessary to meet this requirement, hatch shall be supplied with heavy duty stainless steel pneu-spring for smooth, easy, and controlled door operation throughout the entire arc of opening and closing.
12. Spring shall consist of a minimum ½” stainless steel shaft which slides into a minimum 1” stainless steel tube. Spring shall be charge with an inert gas (nitrogen).
13. Mechanical, torsion, or coil type springs shall not be accepted as equal.
14. Hatch shall be equipped with a self-engaging safety bar to prevent closing
15. Clear open spaces indicated on the drawings shall be provided for all hatches.
16. Hatch shall have fall through protection as specified below.

B. Clear open spaces indicated on the drawings shall be provided for all hatches. Contractor shall verify that pump and rail system will work and fit with the proposed hatch and openings.

C. Fall Through Protection:

1. The Safety Grate shall be made of 6061-T6 aluminum and designed per the Specifications for Aluminum Structures by the Aluminum Association, Inc. 5th Edition, Dec. 1986 for “Bridge Type Structures”.

2. Design shall combine covering of the opening, fall through protection per OSHA Standard 1910.23 and controlled confine space entry per OSHA Standard 1910.146.

3. The grating shall be designed to withstand a minimum live load of 300 pounds per square foot using 17,300 psi as the design stress for the aluminum. Deflection shall not exceed 1/150" of the span.

4. Grate openings shall allow for visual inspection, limited maintenance and float adjustments while the safety grate fall through protection is left in place. Each grate shall be provided with a permanent hinging system, which will lock the grate in the 90° position once opened. Grates in the open position create a visual barrier around the opening, alerting passing pedestrians.

5. Each aluminum safety grate shall be coated with a safety orange color, promoting visual awareness of the hazard, by a powder coat system, applied by the electrostatic spray process. The coating is a thermosetting powder coat finish with a minimum thickness of 2 mils-4 mils and shall be baked at 350°-375°F until cured.

6. See Section 2.01-G below.

D. Manufacturer shall guarantee against defects in hatch material or workmanship for a period of ten years.

E. Contractor shall ensure that the fall protection grates and mounting hardware will not interfere with the placement of the pump guiderails or removal of the pumps from the pump station wet well. Access hatch hinge and mounting brackets shall not be placed above, or within 2 inches of the pump guide rails. The Contractor shall ensure that the pumps can be easily removed and replaced.

2.02 FINISHES

A. Floor Access Doors:
1. Aluminum: Manufacturer’s anodized finish. Top wearing surface shall be ¼” diamond plate unless otherwise noted.
2. Aluminum in Contact with Dissimilar Metals and Concrete: Manufacturer’s standard bituminous coating.
3. Steel: Manufacturer’s standard red oxide primer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine construction to receive access door and verify correctness of dimensions and other supporting or adjoining conditions.

B. Contractor shall replace any defective or damaged equipment at no additional cost to the City.

3.02 PREPARATION

A. Coordinate details with other work supporting, adjoining, or requiring access doors.

B. Verify dimensions, profiles, and fire-resistive rating for each opening.

C. Verify that location will serve portion of work to which access is required. Where proposed functional location conflicts with other work, notify the Engineer before installation.

3.03 INSTALLATION

A. Install access doors in accordance with manufacturer's instructions.

B. Ensure correct types and adequate sizes at proper locations.

C. Securely attach frames to supporting work and ensure doors, frames and hardware operate smoothly and are free from warp, twist and distortion.

D. See 2.01-G above and Section 03400.

3.04 ADJUSTING

A. Adjust doors, frames and hardware to operate smoothly, freely, and properly, without binding.

3.05 CLEANING

A. Thoroughly clean surfaces of grease, oil, or other impurities, touch-up abraded prime coat.

END OF SECTION

SECTION 11312
SUBMERSIBLE PUMPS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for provision of pump systems including submersible non-clog motor-driven pumps for service in raw sewage.

B. Related Sections:

1. Section 01140 - Work Restrictions.
2. Section 01330 - Submittal Procedures.
3. Section 01610 - Seismic Design Criteria.
4. Section 01756 - Testing, Training, and Facility Start-up.
5. Section 15050 - Basic Mechanical Materials and Methods.

1.02 REFERENCES

A. American Bearing Manufacturers Association (ABMA):

1. 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. American Society for Testing and Materials (ASTM):

1. A 48 - Standard Specification for Gray Iron Castings.
2. A 108 - Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
3. A 167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
4. A 176 - Standard Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet and Strip.
5. A 276 - Specification for Stainless Steel Bars and Shapes.
6. A 283 - Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
7. A 532 - Specification for Abrasion-Resistant Cast Irons.
8. A 576 - Specification for Steel Bars, Carbon, Hot Wrought, Special Quality.
9. A 582 - Specification for Free-Machining Stainless and Heat-Resisting Steel Bars.
10. A 743 - Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion-Resistant, for General Application.

11. B 148 - Specification for Aluminum-Bronze Sand Castings.
12. B 505 - Specification for Copper-Base Alloy Continuous Castings.
13. B 584 - Specification for Copper Alloy Sand Castings for General Applications.
14. E 10 - Test Method for Brinell Hardness of Metallic Materials.
15. E 18 - Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials.
16. F 593 - Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
17. F 594 - Specification for Stainless Steel Nuts.

C. American National Standards Institute/Hydraulic Institute (ANSI/HI):
1. 1.1-1.5 - Centrifugal Pumps - Nomenclature, Definitions, Application and Operation.
2. 1.6 - Centrifugal Pump Tests.
3. 9.1-9.5 - General Pump Standards For Types, Definitions, Application, And Sound Measurements.

1.03 DEFINITIONS

A. Pump head (Total Dynamic Head, TDH), flow capacity, pump efficiency, net positive suction head available (NPSHa), and net positive suction head required (NPSHr): As defined in ANSI/HI 1.1-1.5, 1.6 and 9.1-9.5 and as modified in the Specifications.

B. Suction Head: Gauge pressure available at pump intake flange or bell in feet of fluid above atmospheric; average when using multiple suction pressure taps, regardless of variation in individual taps.

C. Tolerances: As defined in ANSI/HI 1.6 and 2.6, or more restrictive tolerances specified herein.

1.04 SYSTEM DESCRIPTION

A. Submersible Pumps with Components: Submersible pump, motor driver, bearings, seals, supports, electrical cable, necessary controls and instrumentation, taps, lifting eyes, lifting cable or chain and guide rails, guide rail supports, self aligning discharge connection, mounting pedestal and similar type items as specified and as required for complete operational units ready for use as specified and installed as indicated on the Drawings.

B. New pumps shall be supplied and installed with all components listed in 1.04A and Part 2 of this Specification section. Pumps supplied and installed shall be rail-mounted submersible (NP Configuration), centrifugal, Flygt pumps having the general characteristics as indicated on the Drawings. The Contractor shall furnish Flygt pumps; no other pump manufacturers will be accepted.
1. 3rd Street Pump Station (Rail-Mounted)
a. Flygt Model NP 3127 LT Adaptive (Two Pumps)

1)	Design Capacity per Pump (gpm)	1264
2)	Rated Total Pump Head at Design (feet)	10
3)	Maximum Rotative Speed (rpm)	1750
4)	Shutoff Head (feet)	36
5)	Motor Horse Power	10
6)	Motor Voltage (3 phase)	230
7)	Discharge Size (inches)	6
8)	Impeller (in)	6.85 (174 mm)
9)	Impeller Material	Hard Iron
10)	Impeller Type	Adaptive N
11)	Pump Curve:	

0	gpm	36.7 ft
200	gpm	33.0 ft
400	gpm	29.1 ft
600	gpm	25.7 ft
800	gpm	21.8 ft
1000	gpm	16.6 ft
1200	gpm	11.3 ft
1400	gpm	6.0 ft

1.05 SUBMITTALS

A. The manufacturer shall submit to the Engineer for approval, certified performance curves, and shop and assembly drawings. The drawings shall show the dimensions, ratings, component parts, arrangements, and materials of construction for all items covered under this section. The performance curves shall be based on data secured during actual tests run at the factory on the pump model proposed for installation, and signed by a responsible manufacturer's representative. The curves shall show the make, model, size, and trim of the impeller, the developed head, brake horse power, NPSH, and efficiency at intervals of 100 gpm in capacity for the model operating at the specified rotative speed over the operating range of the pump.

B. Manufacturer shall supply standard submittals meeting specification Section 01330, and shall contain the following minimum information:

1. Pump Outline Drawings
2. Motor Performance Data
3. Cable and Protective Device Data
4. Typical Installation Guides
5. Certified Pump Performance Curves
6. Fabrication Drawings for Mounting Pedestal
7. Detailed Description and Dimensions of All Accessories
8. Detailed Electrical Data

9. Control Drawings and Data
10. Technical Manuals
11. Parts Lists
12. Printed Warranty
13. Certificates from the Contractor and equipment suppliers that they have properly coordinated the pumps with the Motor Control Center (MCC) supplier and the Motors and MCC are mutually compatible.

1.06 QUALITY ASSURANCE

A. **General:** Pumps shall be suitable for pumping municipal wastewater and shall be designed and fully guaranteed for this use. Motors supplied with submersible pumps under this specification shall be suitable for continuous operation under submerged, partially submerged, or dry conditions. Motors shall be non-overloading throughout the full range of pump operation, as established by the pump model performance curve.

B. **Standards:** Equipment furnished and installed by the contractor shall be in full conformity and harmony with the intent to secure the best standard of construction and equipment as a whole or in part. Pumps shall be installed in strict accordance with manufacturer specifications, their standard drawings, and their installation instructions.

C. **Manufacturer**: All equipment furnished and installed under this section shall be manufactured by Flygt as indicated on the project drawing; no other products will be acceptable. Pumps shall be installed in strict accordance with manufacturer specification, their standard drawings, and their instructions.

D. **Submittals:** Submittal data provided shall be of sufficient depth to illustrate compliance with these specifications, the plans, and other specifications that may influence the proper operation of this pump. No pump equipment shall be shipped until the required drawings and curves have been submitted to and acknowledged by the Engineer as being of general compliance and conformance with the information in the contract documents.

E. **Testing:** Model pumps shall be factory tested to determine head versus capacity, efficiencies, and kilowatt draw required for the operating points specified. All tests shall be run in accordance with the latest edition of the American Hydraulic Institute Standards. The actual pumps furnished shall also be tested for:

1. Impeller, propeller, motor rating, and electrical connections tests shall be run for compliance with specification requirements.
2. Motor and cable insulation test for moisture content or insulation defects shall be performed with a 1,000 volt DC megger.
3. After a submerged test run of 30 minutes under 6 feet of water, Test 2 shall be repeated.
4. If any deviation of the above tests is found, that pump shall be rejected.

F. **Operation and Maintenance Manuals:** The pump supplier shall provide operation and maintenance manuals for all equipment and accessories furnished. The manuals shall be original (no photocopies) and contain at least the following:

1. Identification stating the general nature of the manual, which appears on or is readable through the front cover.
2. Neatly typewritten index near the front of the manual, furnishing immediate information as to location in the manual of all emergency data regarding the equipment.
3. Complete and detailed instructions regarding operation and maintenance of all equipment involved.
4. Complete nomenclature of all replaceable parts, their part numbers, current cost, list of recommended spare parts to be kept on hand, and name, address and telephone number of nearest vendor of parts.
5. Copies of all guaranties and warranties issued.
6. Copies of the favorably reviewed shop drawings with all data concerning changes made during construction.
7. Where content of manuals includes manufacturers' catalog pages, clearly indicate the precise items included in this installation.

G. **Guarantee:** Products furnished and installed under this section shall be guaranteed for a minimum period of five (5) years. Parts and labor for the first eighteen (18) months of this guaranty period shall be provided in full, at no additional cost.

1.07 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 15050.

1.08 PROJECT CONDITIONS

A. Environmental Requirements: As specified in Section 15050.

B. Install pumps as indicated on the drawings.

C. Provide bypass pumping as needed during installation, and as specified.

1.09 SEQUENCING AND SCHEDULING

A. Coordinate with restrictions as specified in Section 01140.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pump: Named manufacturer only. No other manufacturer is acceptable for City maintenance standardization:

1. ITT Flygt, as specified on the project Drawings.

2.02 SUBMERSIBLE PUMPS AND MOTORS

A. Pumps shall be designed for municipal wastewater. Pump characteristics shall be such that the motor nameplate rating is not exceeded at any point on the operating curve.

B. Pumps shall be the Flygt models specified herein and shall have intake and discharge dimensions specified herein and as shown on the plans. The pumps shall be suitable for wet-pit installation. All pumps and motors shall be explosion-proof (X Designation).

C. Pump and motor characteristics; including pump design and construction, cable seal, cooling system, wear rings, seals, impellers, bearings and motors; shall strictly meet Flygt's published Performance Specification (latest release).

D. Pump motors shall be the squirrel-cage induction type, housed in a NEMA B air filled, watertight chamber, rated for continuous full load operation. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. Motors shall be capable of withstanding up to 15 starts per hour and shall have a minimum 1.15 service factor.

E. The impellers shall be dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the gray iron impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge, and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

F. The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed.

G. **Nameplates:** Motors shall have a stainless steel plate showing the motor connection diagram and a stainless steel nameplate indicating type, frame, insulation class, full load current, horsepower, full load minimum guaranteed efficiency and nominal power factor, rpm, degree rise in Celsius, maximum ambient temperature rating in degrees Celsius, manufacturer's name, serial number, model, voltages, locked motor Kva code and bearing numbers.

2.03 ACCESSORIES

A. Pump accessories shall be furnished by the pump manufacturer and be compatible with each of the submersible pumps and the conditions of their installation.

B. All accessory hardware including anchor bolts and cable brackets shall be Type 316 stainless steel.

C. Accessories for each submersible pump and motor:

D. Accessories for each submersible pump and motor:

1. Discharge connection and base pedestal for mounting to concrete slab. Wet well submersible pump discharge connections shall be self-aligning.
2. Stainless steel guide rails and mounting accessories, where applicable, as recommended by the pump manufacturer for pump removal and installation without the need to enter the wet well.
3. Intermediate guide bar brackets for guide rails where applicable.
4. Discharge Elbow.
5. At least 30 LF of submersible motor cable or as necessary to complete the installation.
6. Cable holder.
7. At least 25 LF of stainless steel lifting chain.
8. Lifting eye compatible with the pump.
9. Dual moisture sensing probe system to detect the entrance of moisture and provide an alarm. The moisture detection system shall be designed to detect the entrance of moisture in the high heat transfer fluid reservoir and the air-filled motor stator housing.
10. A316 stainless steel anchor bolts as recommended by the pump supplier and any other miscellaneous supplies required to complete the installation.
11. A selection of spare parts shall be included with each pump. The minimum spare parts included shall be bearings, mechanical seals, o-rings, and wear rings.

2.04 DISCHARGE ELBOW

A. Discharge elbow to mate to pump discharge and transition to discharge piping.

B. The entire weight of the pump/motor shall be supported by the pump discharge elbow. Provide seismic resistance and anchorage in accordance with Section 01610.

2.05 COATINGS

A. Equipment shall receive final finish coats at the factory. Each coat of paint shall be of the consistency as supplied by the paint manufacturer, or thinned if necessary, and applied in accordance with the manufacturer's written instructions. Work shall

be free from “runs”, “bridges”, “shiners”, or other imperfections. Care shall be taken to obtain a uniform, unbroken coating over welds, edges, and corners. Weld splatter shall be removed and all welds neutralized with thinner. Blasted surfaces shall be coated within four hours of being sandblasted. All dust shall be removed from surfaces prior to coating.

B. All surfaces to be coated or painted shall be in the specified condition to receive the material before any coating or painting is performed. Follow manufacturer's instructions. During and after final application of protective coatings, all metal surfaces shall be checked mechanically with an Elcometer, Mikrotest, or other approved dry film thickness gage to insure that the specified dry film thickness has been attained. Coating testing and repair of damages, flawed areas, holidays, or mishaps shall conform to applicable AWWA standards.

C. Care shall be taken to prevent damage to coated surfaces during shipment. Any coatings damaged during shipment shall be refinished as the original at no extra cost to the City.

D. Coatings shall be guaranteed for a period of one year following the date of final acceptance.

PART 3 EXECUTION

3.01 INSTALLATION

A. Pumps shall be installed in strict accordance with the manufacturer’s approved procedures, specifications and their instructions.

B. Anchor bolts and grout pads for the pump pedestals shall be drilled and epoxied into place per Section 03300 after the pumps and discharge piping are set.

3.02 FIELD QUALITY CONTROL

A. Witnessing: All field testing shall be witnessed by the ENGINEER; provide advanced notice of field testing as specified in Section 01756.

B. Inspection and Check-out: As specified in Section 15050.

C. Equipment Performance Test: Test pump operations using automatic level controls as scheduled with the City and described herein.

D. All water and electricity required for field testing shall be provided at CONTRACTOR’s sole expense.

E. Operational Testing:

1. After installation, equipment shall be tested in the presence of the Engineer by an authorized pump manufacturer representative who shall certify, in writing, that the pumps are operating in compliance with these specifications and are free from binding, scraping, overloading, vibration or other defects.

2. Each pumping unit shall be run and monitored for a minimum duration of one (1) hour during the test period. A minimum of 6 pump cycles shall occur during pump testing. Motor running current readings shall be taken for each phase. Coordinate testing with the City.
3. The manufacturer's representative shall perform the following:
    a. Check motor stator and power cables.
    b. Check seal lubrication.
    c. Check for proper rotation.
    d. Check power supply voltage.
    e. Measure motor operating load and no load current for each phase.
    f. Check level control operation and sequence.

3.03 MANUFACTURER'S FIELD SERVICES

A. Require manufacturer to inspect system before initial start-up and certify that system has been correctly installed and prepared for start-up as specified in this section and Section 15050.

B. Training: As specified in Section 01756.

C. The pump manufacturer shall be present during pump station start-up.

END OF SECTION

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SECTION 15050
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Basic design and performance requirements for mechanical equipment.

B. Related Sections:

1. Section 01610 - Seismic Design Criteria.
2. Section 01756 - Testing, Training, and Facility Start-up.
3. Section 01782 - Operating and Maintenance Data.
4. Section 03600 - Grouts.
5. Section 05501 - Anchor Bolts.
6. Section 11312 - Submersible Pumps.

1.02 REFERENCES

A. American Gear Manufacturer's Association (AGMA) Standards:

1. AGMA 2001-B88 - Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
2. AGMA 6000-A88 - Specification for Measurement of Linear Vibration on Gear Units.
3. AGMA 6010-E88 - Standard for Spur, Helical, Herringbone, and Bevel Enclosed Drives.
4. AGMA 6019-E89 - Standard for Gear motors using Spur, Helical, Herringbone, Straight Bevel or Spiral Bevel Gears.
5. AGMA 6025-C90 - Sound for enclosed Helical, Herringbone and Spiral Bevel Gear Drives.

B. American Society of Mechanical Engineers (ASME):

1. ASME PTC 8.2 - Performance Test Code for Centrifugal Pumps.
2. ANSI/ASME PTC 10 - Performance Test Code - Compressors and Exhausters.
3. ANSI/ASME PTC 17 - Performance Test Code - Reciprocating Internal-Combustion Engines.
4. ANSI/ASME PTC 11 - Performance Test Code - Measurement of Shaft Horsepower - Instruments and Apparatus.

C. American Bearing Manufactures Association (ABMA) Standards:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

D. American Society for Testing and Materials (ASTM):

1. A 36 - Standard Specification for Structural Steel.
2. A 48 - Standard Specification for Gray Iron Castings.
3. A 526 - Standard Specification for Steel Sheet, Zinc Coated by the Hot Dip Process, Commercial Quality.
4. B-61 - Standard Specification for Steam or Valve Bronze Castings.
5. B 62 - Standard specification for Composition Bronze or Ounce Metal Castings.
6. E 527 - Standard Practice for Numbering Alloys and Metals (UNS).

E. American National Standards Institute/Hydraulic Institute Standards (ANSI/HI):

1. ANSI/HI 1.1-1.5 - Centrifugal Pumps - Nomenclature, Definitions, Application and Operation.
2. ANSI/HI 1.6 - Centrifugal Pump Tests.
3. ANSI/HI 2.1-2.5 - Vertical Pumps - Nomenclature, Definitions, Application and Operation.
4. ANSI/HI 2.6 - Vertical Pump Tests.
5. ANSI/HI 3.1-1.5 - Rotary Pumps - Nomenclature, Definitions, Application and Operation.
6. ANSI/HI 3.6 - Rotary Pump Tests.
7. ANSI/HI 4.1-4.6 - Sealless Rotary Pumps - Nomenclature, Definitions, Application, Operation and Test.
8. ANSI/HI 5.1-1.6 - Sealless Centrifugal Pumps - Nomenclature, Definitions, Application, Operation and Test.
9. ANSI/HI 6.1-6.5 - Reciprocating Power Pumps - Nomenclature, Definitions, Application and Operation.
10. ANSI/HI 7.1-7.5 - Controlled Volume Pumps - Nomenclature, Definitions, Application and Operation.
11. ANSI/HI 9.1-9.5 - Pumps - General Guidelines for Types, Definitions, Application and Sound Measurement.

1.03 DEFINITIONS

A. Special Tools: Tools that have been specifically made for use on unit of equipment for assembly, disassembly, repair, or maintenance.

B. Resonant Frequency: That frequency at which a small driving force produces an ever-larger vibration if no dampening exists.

C. Rotational Frequency: The revolutions per unit of time usually expressed as revolutions per minute.

D. Critical Frequency: Same as resonant frequency for the rotating elements or the installed machine and base.

E. Peak Vibration Velocity: The root mean square average of the peak velocity of the vibrational movement times the square root of 2 in inches per second.

F. Rotational Speed: Same as rotational frequency.

G. Maximum Excitation Frequency: The excitation frequency with the highest vibration velocity of several excitation frequencies that are a function of the design of a particular machine.

H. Critical Speed: Same as critical frequency.

I. Free Field Noise Level: Noise measured without any reflective surfaces (an idealized situation); sound pressure levels at 3 feet from the source unless specified otherwise.

1.04 SYSTEM DESCRIPTION

A. General:

1. Provisions specified under each technical equipment specification prevail over and supersede conflicting provisions as specified in this Section.
2. Provide equipment and parts that are suitable for stresses which may occur during fabrication, transportation, erection, and operation.
3. Provide equipment that has not been in service prior to delivery, except as required by tests.
4. Like parts of duplicate units are to be interchangeable.
5. When two or more units of equipment for the same purpose are required, provide products of same manufacturer.
6. Equipment manufacturer's responsibility extends to selection and mounting of gear drive units, motors or other prime movers, accessories, and auxiliaries required for proper operation.
7. When necessary, modify manufacturer's standard product to conform to specified requirements or requirements indicated on the Drawings and contained in Laws and Regulations.

B. Material Requirements:

1. Materials: Suitable for superior corrosion resistance and for services under conditions normally encountered in similar installations.
2. Dissimilar Metals: Separate contacting surfaces with dielectric material.

C. Equipment Mounting and Anchoring:

1. Mount equipment on cast iron or welded steel bases with structural steel support frames. Utilize continuous welds to seal seams and contact edges between steel members. Grind welds smooth.
2. Provide bases and supports with machined support pads, dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits.
3. Provide jacking screws in bases and supports for equipment weighing over 1,000 pounds.
4. Anchor equipment base to concrete pad. Determine number, size, type, and location of bolts, anchor bolts, or other connections.
5. Provide bolt sleeves for anchor bolts for heavy equipment. Adjust bolts to final location and fill sleeve with non-shrink grout.

D. Structural Design:

1. Design connections and related details for seismic design criteria as specified in Section 01610.
2. For equipment with operating weight of 400 pounds or more provide calculations for:
   a. Determination of operating weight and centroid of equipment.
      1) Operating weight is to be weight of unit plus weight of fluids or solids normally contained in unit during operation.
   b. Determination of seismic forces and overturning moments.
   c. Determination of shear and tension forces in connections.
   d. Design of connection details based on calculated shear and tension forces.

E. Equipment Units Weighing 50 Pounds or More: Provide with lifting lugs or eyes to allow removal with hoist or other lifting device.

1.05 SUBMITTALS

A. Product Data:

1. For each item of Equipment:
   a. Design features.
   b. Load capacities.
   c. Efficiency ratings.
   d. Material designations by UNS alloy number or ASTM Specification and Grade.
   e. Data needed to verify compliance with the Specifications.
   f. Catalog data.
   g. Name plate data.

h. Clearly mark submittal information to show specific items, materials and accessories or options being furnished.

2. Gear Reduction Units:

a. Engineering information per applicable AGMA standards.

b. Gear mesh frequencies.

B. Shop Drawings:

1. Drawings for Equipment:

a. Drawings that include outline drawings, cut-away drawings, parts lists, material specification lists, and other information required to substantiate that proposed equipment complies with specified requirements.

2. Outline drawings showing equipment, driver, driven equipment, pumps, seal, motor(s) or other specified drivers, variable frequency drive, shafting, U-joints, couplings, drive arrangement, gears, baseplate or support dimensions, anchor bolt sizes and locations, bearings, and other furnished components.

3. Installation and checkout instructions including leveling and alignment tolerances, grouting, lubrication requirements, and initial start-up procedures.

4. Wiring, control schematics, control logic diagrams and ladder logic or similar for computer based controls.

5. Recommended or normal operating parameters such as temperatures and pressures.

6. Alarm and shutdown set points for all controls furnished.

C. Calculations:

1. Calculations and other information to substantiate base plates, supports, and anchor bolts meet minimum design strength requirements and seismic design criteria specified in Section 01610.

2. Bearing L_{10} life calculations in accordance with ABMA 9 or ABMA 11 calculation methods for drivers, pumps, gears, shafts, motors, and other drive line components with bearings.

3. Calculations and other information to substantiate that operating rotational frequencies meet the requirements of this Section.

4. Torsional Analysis of Power Transmission Systems: When torsional analysis specified in the equipment Sections, provide:

a. Sketch of system components identifying physical characteristics including mass, diameter, thickness, and stiffness.

b. Results of analysis including first and second critical frequencies of system components and complete system.

5. Calculations for connection details demonstrating compliance with specified structural design requirements.

6. Require Professional Engineer registered in state where Project is located to stamp and sign calculations.

D. Quality Control Submittals:

1. Source quality control reports and certified test data.
2. Submit factory test reports before shipment.
3. Certified static and dynamic balancing reports for rotating equipment.
4. Field quality control reports and test data.
5. Start-up Plan: Proposed plan for field-testing equipment as specified in Section 01756.
6. Certificate of Proper Installation: As specified in Section 01756.
7. Submit material test reports a specified in the equipment sections.

E. Operation and Maintenance Manuals:

1. As specified in Section 01782.
2. Submit prior to training of OWNER's personnel.
3. Make available at project site complete copy of manuals for use by field personnel and ENGINEER during start-up and testing of equipment.
4. Include manufacturer and model number of every bearing; include calculated ball pass frequencies of the installed equipment for both the inner and outer raceways.
5. Include motor rotor bar pass frequencies.

1.06 QUALITY ASSURANCE

A. Qualifications: Equipment manufacturer and system component manufacturers to have a minimum of 5 years experience in the design, manufacture, and assembly of the specified equipment and components with an established record of successful operation of such equipment and components.

B. References: Provide references from a minimum of 3 installations currently operating the same model equipment in continuous service for a minimum of 2 years under similar operating conditions. Reference information shall include location, service, contact person, and contact phone number.

C. Manufacturer's Field Service:

1. Furnish services of authorized representative specially trained in installation of equipment.
    a. Visit project site and perform tasks necessary to certify installation.
    b. Furnish Certificate of Proper Installation as specified in Section 01756.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Equipment: Pack in boxes, crates, or otherwise protect from damage and moisture, dust, or dirt during shipment, handling, and storage.

2. Bearings: Separately pack or otherwise suitably protect during transport.
3. Spare Parts: Deliver in boxes labeled with contents, equipment to which spare parts belong, and name of CONTRACTOR.

B. Storage:

1. Equipment Having Bearings: Store in enclosed facilities. Rotate units at least once per month or more often as recommended by the manufacture to protect rotating elements and bearings.

C. Protection:

1. Equipment: Protect equipment from deleterious exposure.
2. Painted Surfaces: Protect against impact, abrasion, discoloration, and other damage.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:

1. Equipment for project is to be suitable for performance in a wastewater pumping plant environment and under following conditions:
   a. Ambient Temperatures: freezing to 95 degrees Fahrenheit.
   b. Relative Humidities: 60 to 100 percent.
   c. Site Elevation: About 10 feet above mean sea level.
   d. Other: Coastal fog.

1.09 SEQUENCING AND SCHEDULING

A. Equipment Anchoring: Obtain from equipment manufacturers' anchoring material and templates or setting drawings in time for anchors to be cast-in-place when concrete is placed.

B. Coordinate details of equipment with other related parts of the Work, including verification that structures, piping, wiring, and equipment components are compatible.

C. General Start-up and Testing of Equipment:

1. Perform general start-up and testing procedures after operation and maintenance manuals for equipment have been received.
2. Conduct functional testing of mechanical or electrical systems when each system is substantially complete and after general start-up and testing procedures have been successfully completed.
3. Functional testing requirements as specified in Sections 01756 and the equipment sections.

1.10 WARRANTY

A. Warranty: Where no specific term of warranty is provided in a technical specification, warrant equipment free of defects in material and workmanship for one year from the date of acceptance or date of first beneficial use of the equipment by the OWNER; cover parts and labor.

B. Where a warranty exceeds one year, manufacturer's warranty shall be issued in the OWNER's name.

1.11 MAINTENANCE

A. Special Tools:

1. When specified, provide special tools required for operation and maintenance.
2. Mark or tag and list such tools in maintenance and operations instructions. Describe use of each tool.

B. Spare Parts:

1. Assume responsibility until turned over to OWNER.
2. Store in enclosed facilities.
3. Furnish itemized list and match identification tag attached to every part.
4. List parts by generic title and identification number.
5. Furnish name, address, and telephone number of supplier and spare parts warehouse.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ferrous Materials:

1. Steel for Members used in Fabrication of Assemblies: ASTM A 36.
2. Iron Castings: ASTM A 48, tough, close-grained gray iron, free from blowholes, flaws, and other imperfections.
3. Galvanized Steel Sheet: ASTM A 526, minimum 0.0635 inch (16 gauge).
4. Expanded Metal: ASTM A 36, 13 gauge, 1/2 inch flat pattern expanded metal.

B. Nonferrous Materials:

1. Stainless Steel: Type 304 or 316 as specified; provide L grade where welding required.
2. Bronze in Contact with Liquid: Composition of not more than 2 percent aluminum nor more than 6 percent zinc; UNS Alloy C83600, C92200 or C92700 in accordance with ASTM B 62, B-61, B-505, or B-584, when not specified otherwise.

C. Dielectric Materials for Separation of Dissimilar Metals:

1. Neoprene, bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other materials.

D. Anchors Bolts: As specified

E. Non-Shrink Grout: As specified in Section 03600.

2.02 WARNING SIGNS

A. Provide for equipment that starts automatically or remotely.

B. Material and Size: Rigid Acrylic, 12” x 9” with pre-drilled mounting holes.

C. Colors: Per OSHA standards for danger and warning signs.

D. Submit catalog cut sheet for approval.

2.03 FABRICATION

A. Structural Steel Members: As specified in Sections 05120 and 05505.

B. Nameplates:

1. Engraved or stamped on Type 304 stainless steel and fastened to equipment at factory in an accessible and visible location.
2. Indicate Following Information as Applicable:
    a. Manufacturer's name.
    b. Equipment model number and serial number.
    c. Maximum and Normal rotating speed.
    d. Horsepower.
    e. Rated capacity.
    f. Service class per applicable standards.
3. Nameplates for Pumps: Include:
    a. Rated total dynamic head in feet of fluid.
    b. Rated flow in gallons per minute.
    c. Impeller, gear, screw, diaphragm, or piston size.

C. Bolt Holes in Equipment Support Frames: Do not exceed bolt diameter by more than 25 percent, up to limiting maximum diameter oversize of 1/4 inch.

D. Shop Finishing:

1. Provide factory and field coating as specified in Section 09960. If not specified in Section 09960, provide coating as follows:

a. Bases and Support Frames in Contact with Concrete or Other Material: Paint contacting surfaces with minimum of 2 coats of zinc chromate primer before installation or grouting.

b. Shop Primer for Steel and Iron Surfaces, Unless Specified Otherwise:

1) Manufacturers: One of the following or equal:

a) Ameron, Amercoat 185 Universal Primer.

b) Cook, 391-N-167 Barrier Coat.

c) Kop-Coat, Pug Primer.

d) Tnemec, 37-77 Chem-Prime.

e) Valspar, 13-R-28 Chromox Primer.

c. Coat machined, polished, and nonferrous surfaces which are not to be painted with rust-preventive compounds.

1) Manufacturers: One of the following or equal:

a) Houghton, Rust Veto 344.

b) Rust-Oleum, R-9.

d. Coating for Ferrous Metal Surfaces, Except Stainless Steel: High solids polyamine epoxy.

e. Finish Painting of Motors: Shop finish paint with manufacturer's standard coating, unless otherwise specified in Section 09910.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect all components for shipping damage, conformance to specifications, and proper torques and tightness of fasteners.

3.02 PREPARATION

A. Metal Work Embedded in Concrete:

1. Accurately place and hold in correct position while concrete is being placed.

2. Clean surface of metal in contact with concrete immediately before concrete is placed.

B. Concrete Surfaces Designated to Receive Grout:

1. Give surfaces heavy sandblasting treatment.

2. Clean surfaces of sandblasting sand, grease, oil, dirt, and other foreign material that may reduce bonding of grout.

3. Concrete Saturation: Saturate concrete with water. Concrete surface shall be damp concrete at time grout is placed.

C. Field Measurements:

1. Prior to fabrication of equipment, take measurements for installation of equipment and verify dimensions indicated on the Drawings. Ensure equipment and ancillary appurtenances fit within available space.

3.03 INSTALLATION

A. Install equipment in accordance with manufacturer's installation instructions and recommendations.

B. Grouting Equipment Bases:

1. Comply with manufacturer's installation instructions for grouting spaces, type of grout, and tolerances for level and alignments, both vertical and horizontal.

2. Grout base when piping connections are complete and in alignment with no strain transmitted to equipment.

3. Grout base when equipment is leveled and in alignment.

4. Place grout, filling voids under equipment bases including recesses between anchor bolts and sleeves.

a. Extend grout to edge of bases or bedplates and bevel at 45 degrees around units.

b. Finish surfaces with slope that prevents ponding water within grouted areas.

5. Grout: As specified in Section 03600.

C. Special Techniques: Use applicable special tools and equipment, including precision machinist levels, dial indicators, and gauges as required in equipment installations.

D. Tolerances:

1. Completed Equipment Installations: Comply with requirements for intended use and specified vibration and noise tolerances.

E. Warning Signs: Mount securely with stainless fasteners at equipment which can be started automatically or from remote locations.

3.04 FIELD QUALITY CONTROL

A. Perform operational testing as required by Section 01756.

3.05 MANUFACTURER'S REPRESENTATIVE

A. Field Checkout: Before field testing and start-up, provide services of factory-trained field service representative to certify the equipment has been installed, aligned and checked in accordance with the manufacturers instructions and the Specifications.

B. Testing: Provide services of factory trained representative to observe and advise the CONTRACTOR during field quality control testing.

C. Training: When training is specified, provide services of factory-trained representative to perform training as specified in Section 01756.

END OF SECTION

SECTION 15100
PIPING, FITTINGS, AND VALVES

PART 1 - GENERAL

1.01 DOCUMENTS

The General Conditions and all other Contract Documents for this project are complementary and applicable to this section of the Specifications.

1.02 SCOPE OF WORK

A. **Work Included:** Pipe, fittings, valves, connections, supports, anchors and all other necessary appurtenances as shown, specified, and/or required. Inspection of new pipe to be installed.

B. **Related Work Specified Elsewhere**

1. Submersible Pumps: Section 11312.
2. Pipe System Testing: Section 02770

1.03 REFERENCE STANDARDS

Standards listed below are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of listed standards, the requirements of this section shall prevail.

A. ANSI B16.1 *Cast Iron Pipe Flanges and Flanged Fittings*

B. AWWA C104 *Cement-Mortar Lining for Ductile Iron Pipe and Fittings*

C. AWWA C110 *Ductile Iron and Gray Iron Fittings, 3-inch through 48-inch*

D. AWWA C111 *Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings*

E. AWWA C115 *Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges*

F. AWWA C116 *Protective Fusion-bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings*

G. AWWA C151 *Ductile Iron Pipe, Centrifugally Cast*

H. AWWA C207 *Steel Pipe Flanges for Waterworks Service*

I. AWWA C-606 *Grooved and Shouldered Joints*

J. ASTM D3350 *Polyethylene Plastics Pipe and Fittings Materials*

K. ASTM D1248 *Polyethylene Plastics Extrusion Materials for Wire and Cable*

1.04 QUALITY ASSURANCE

A. The Contractor shall furnish all labor necessary to assist the Engineer in inspecting pipe upon delivery. The Contractor shall remove rejected pipe immediately.

B. All pipe of any manufacturer may be rejected if there are unsatisfactory joint assembly operations, even if the pipe conforms to ANSI and AWWA Specifications. The Contractor shall remove all unsatisfactory pipe of that manufacturer of same shipment from work and shall furnish pipe from another manufacturer conforming to these specifications.

C. All tests shall be made in conformance with methods prescribed by ASTM and AWWA specifications, and acceptance or rejection is based on the test results.

E. All new force main pipe shall be tested per Section 02770.

1.05 SUBMITTALS

A. **Product Data**: The Contractor shall submit shop plans, manufacturer's product data and installation instructions demonstrating that the proposed pipe and fittings are in compliance with the referenced standards as well as the intended service. If plans are returned disapproved or not stamped, they shall be revised or corrected as necessary and resubmitted for review, approval, and stamping.

B. **Certification**: Certified test reports with each delivery that pipe complies with this specification.

PART 2 - PRODUCTS

2.01 PIPE AND TUBE

A. **General:** Pipe sizes are nominal inside diameter unless otherwise noted. All sizes shall be as called out on the plans and specified herein. All pipe and fittings delivered to the job site shall be clearly marked to identify the material, class, thickness, and manufacturer. All material shall be new and free of blemishes.

The Contractor is responsible for furnishing and installing all items necessary to make a complete and workable piping system. These include, but are not limited to, valve boxes, manholes, insulating couplings and gaskets, piping specialties and all other items required by the nature of the installation. Any item not specified herein but required by the nature of the installation shall be of the first quality and equal in grade to similar materials specified herein.

B. **Ductile Iron Pipe:** Manufactured in accordance with AWWA C151, Pressure Class 350 ductile iron pipe with threaded flanges.

1. Ductile Iron Pipe shall be interior lined with Protecto 401 Ceramic Epoxy or Tnemec 431 Perma-Shield. The lining material shall be amine cured novalac epoxy

containing at least 20 percent by volume of ceramic quartz pigment. The dry film thickness shall be no less than 40 mils. Exterior coating shall be:

a. Buried Pipe: Buried pipe shall be coated with asphaltic material as specified in AWWA C151. A minimum thickness of 1-mil asphaltic coating shall be applied.

b. Exposed Pipe: Exposed pipe within the wetwell, valve vault, and under the Cola Ballena bridge shall be coated with an exterior protective pipe coating incorporating high solids amine cured epoxy for maximum protection of the exterior of ductile iron pipe. Coating shall be Tnemec Series 141 at a minimum of 16 mils dry film thickness, or US Pipe Ceramawrap at a minimum dry film thickness of 20 mils.

2. Ductile Iron Pipe shall be prepared per the National Association of Pipe Fabricators Standard NAPF 500-03.

C. **HDPE Gravity Storm Drain Pipe**

1. HDPE Materials:

a. Pipe manufactured for this specification shall comply with the requirements for test methods, dimensions, and markings found in AASHTO M252 Type S for 4" – 10" diameters and AASHTO M294 Type S or ASTM F2306 for 12" – 60" diameters. As further defined and described in AASHTO M252, AASHTO M294 and ASTM F2306, the prescribed sizes of pipe are nominal inside diameters. Pipe diameter tolerance shall be 4.5 percent oversize and 1.5 percent undersize. Pipe lengths shall not be less than 99 percent of the manufactures stated length.

b. Pipe supplied shall be smooth Interior and Annular Exterior Corrugated High Density Polyethylene (HDPE) Pipe meeting the requirements of AASHTO M252, Type S. The pipe supplied shall be watertight as defined in the joint performance requirements of this specification.

c. Watertight joints shall be bell-and-spigot meeting the watertight requirements of AASHTO M252, M294 or ASTM F2306. Watertight joints shall meet the ASTM D3212 10.8 psi (74kPa) laboratory test. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.

2. HDPE Fittings: Shall conform to AASHTO M252, M294 or ASTM F2306.

3. Bedding and Backfill: As specified in Section 02200 and as shown on the plans.

4. HDPE Couplings: HDPE Couplings used to join existing and new HDPE pipe as shown on the drawings shall be Hancor PVC Repair Sleeves or approved equal.

5. APPROVED MANUFACTURERS. Hancor Hi-Q, ADS N-12, or approved equal.

2.02 FITTINGS

A. **Material:** Fittings for ductile iron pipe shall conform to AWWA C110.

B. **Pattern:** All fittings shall be flanged to ANSI B16.1 Class 125 standard pattern.

C. **Coating and Lining:** Flanged fittings shall be fusion bond epoxy lined and coated at the factory in conformance with AWWA C116.

2.03 FLAP GATE VALVES

A. Flap gate valves shall be specifically designed for pump discharge locations with velocities up to 10 feet per second.

B. Flap gate valves shall have a flanged connection conforming to ANSI Class 125.

C. Flap gate valve shall be Waterman PF-25 Flap Valve or approved equal.

2.04 PIPE JOINTS AND COUPLINGS

A. Discharge pipe shall be joined by flanged, mechanical or grooved joints as shown on the Drawings.

B. **Flanged Joints:** Provide full face gaskets per AWWA C111.

C. **Restrained Flanged Coupling Adapters (RFCA)**: Restrained flange coupling adapters shall be provided as shown on the Drawings and as deemed necessary by the Contractor for pipe assembly. Couplings shall be EBAA Iron 2100 Megaflange restrained flange adapter, or approved equal. Cast gland bodies shall be coated with MEGA-BOND.

D. **Thrust Restraint Glands:** All fittings, joints, and connections shall be restrained against trust. Thrust restraint glands shall be EBAA Iron MEGALUG Series 1100. Thrust restraint gland for PVC force main pipe shall be specifically designed for the use with C900 PVC pipe such as EBAA Iron MEGALUG 2000PV or approved equal. Cast gland bodies shall be coated with MEGA-BOND. All hardware shall be stainless steel and all nuts and bolts shall be coated with Xylan Fluoropolymer coating.

E. **Gaskets, Bolts and Nuts**: Gaskets shall be rated for wastewater service, made of synthetic rubber such as Buna-N not less than one-eighth (1/8) inch thick. All gaskets shall be the full width of the flange to which applied. Bolts and nuts shall be ASTM A316 stainless steel, and shall have sound well-fitting threads. Nuts and bolts shall be coated with Xylan Fluoropolymer coating. Bolts shall be provided with hexagonal chamfered heads and nuts. The underside of all bolt heads and nuts shall have true surfaces at right angles to the axis of the bolts. The lengths of the bolts shall be such that after joints are made up, the bolts shall protrude through the nuts, but in no case shall they protrude more than one-half (½) inch.

2.05 PLASTIC FILM WRAP

All ductile-iron and steel pipe and fittings buried underground shall be protected with plastic film wrap in accordance with AWWA C105, unless noted otherwise below. Wrap shall be a

loose 8-mil-thick polyethylene tube. All joints between plastic tubes shall be wrapped with 2-inch-wide polyethylene adhesive tape, Polyken 900, Scotch wrap 50, or approved equal.

2.06 SUPPORTS, ANCHORS, AND SEALS

A. Support for the pump discharge piping shall be provided as detailed on the Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

Foreign material, scale and dirt, inside and outside, shall be removed from pipe and fitting materials before assembly.

3.02 CONNECTIONS

A. Pipe connections shall be made in accordance with applicable standards and manufacturer's recommendations.

B. Non-conducting connections shall be provided wherever jointing dissimilar metals.

3.03 INSTALLATION

A. **General**: Pipe shall be installed in accordance with good trade practice and AWWA C600. The methods employed in the handling and placing of pipe, fittings, and equipment shall be such as to insure that after installation and testing they are in good condition. Should damage occur to the pipe, fittings, or equipment, repairs satisfactory to the City shall be made at no additional cost to the City.

B. **Handling and Storage of Pipe**: During loading, transportation, and unloading, every precaution shall be taken to prevent pipeline damage. Any damaged pipe shall be replaced or repaired to the satisfaction of the City. Where pipe is placed in stockpiles, it shall be neatly piled and blocked with strips between tiers.

END OF SECTION

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SECTION 16001

POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SCOPE

A. Provide a complete, computer based, short circuit study, equipment interrupting and withstand evaluation, protective device coordination study, and arc flash study for the project electrical distribution system. Provide arc flash labels for all electrical equipment included in the project.

B. The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low voltage distribution system for equipment in this project. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly covered in the study.

C. Obtain from the utility company the fault duty information necessary for the study, including service transformer primary protection, transformer ratings, impedance, X/R ratio, and secondary service conductor material and size.

1.02 RELATED SECTIONS

A. Section 16080 Electrical Acceptance Testing

B. Section 16401 Service Pedestal

C. Section 16901 Pump Control Panel

1.03 REFERENCE STANDARDS

A. The power system study shall be conducted in accordance with the latest edition of the following applicable standards:

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE 399	Recommended Practice for Power System Analysis
IEEE 620	Guide for the Presentation of Thermal Limit Curves for Squirrel Cage Induction Machines
IEEE 1584	Guide for Performing Arc Flash Hazard Calculations

INSULATED CABLE ENGINEEERS ASSOCIATION (ICEA)

ICEA P-32-382	Short Circuit Characteristics of Insulated Cables

CALIFORNIA CODE OF REGULATIONS (CCR)
TITLE 24, 2019 California Electrical Code (CEC)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
NFPA 70E Standard for Electrical Safety in the Workplace

1.04 SUBMITTALS

A. All studies shall be submitted to the Owner prior to granting the final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture.

B. Study Report

1. The results of the power system study shall be summarized in a final report. Bound copies of the final report and an electronic copy on a CD shall be submitted to the Owner for approval.

2. The report shall include the following sections:

a. Description, purpose, basis and scope of the study; and a single line diagram of the portion of the power system which is included within the scope of study.

b. Fault current study with tables listing all input data used, detailed short circuit calculations at each system bus, and tables summarizing the short circuit contribution at each bus, both interrupting and momentary short circuit currents for 3-phase and phase to ground faults.

c. Equipment evaluation report, with tabulations of circuit breaker, fuse, and other equipment ratings versus calculated short circuit duties, and commentary regarding same.

d. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

e. Tabulation of arc-flash hazard analysis results at each of the equipment.

PART 2 MATERIALS

2.01 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Analytical features of fault current study computer software program shall include “mandatory”, “very desirable”, and “desirable” features as listed in IEEE 3999 Table 7-4.

B. Computer software program shall be capable of plotting and diagramming time-current characteristics curves as part of its output. Computer software program shall report device settings and rating of all overcurrent protective devices and shall

demonstrate selective coordination by computer generated time-current coordination plots.

C. Computer software program shall be capable of calculating Arc Flash Incident Energy (AFIE) levels and flash protection boundary distances.

D. Acceptable software product is SKM Systems Analysis, Inc.

PART 3 EXECUTION

3.01 SHORT CIRCUIT STUDY

A. The study shall be in accordance with IEEE Standard 242, 399, and 620.

1. The study input data shall include the utility company's short circuit single and three phase contribution, with the X/R ratio for each resistance and reactance components of the branch impedances, motor, and generator contributions, base quantities selected, and all other applicable circuit parameters.

2. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the main switchboard bus, motor control center, pertinent branch circuit panelboards, and other significant locations through the system. Conductor impedances at 75°C shall be used to determine worst-case resistance values.

3.02 EQUIPMENT EVALUATION STUDY

A. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arrestors, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents. Any problem areas or inadequacies in the equipment shall be promptly brought to the Owner's attention prior to fabrication or ordering of affected equipment.

3.03 PROTECTIVE DEVICE COORDINATION STUDY

A. A protective device coordination study shall be performed to select or to check the selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, low voltage breaker trip characteristics and settings. Use only data on the actual equipment being provided.

B. The coordination study shall include all voltage classes of equipment from the utility's transformer and from the standby generator down to and including, each motor control center feeder and/or panelboard. The phase and ground overcurrent protection shall be included as well as settings for all other adjustable protective devices.

C. The time-current characteristics of the specified protective devices shall be plotted on the appropriate log-log paper similarly scaled computer printer output. The plots shall include complete titles, representative one-line diagram and legends, associated power company's relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves, and fuse curves. The coordination plots where applicable, shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, ANSI transformer magnetizing inrush and withstand curves per ANSI C37.91, cable damage curves, symmetrical and asymmetrical fault currents. All requirements of the 2019 California Electrical Code shall be adhered to. Reasonable coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a system basis. Separate curves shall be used to clearly indicate the coordination achieved, where applicable, for each main breaker, feeder breaker and load protective device rated 100 amps or more. There shall be a maximum of six protective devices per plot.

D. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system. Discrepancies, problem areas, or inadequacies shall be promptly brought to the Owner's attention prior to fabrication or ordering of affected equipment.

E. Circuit breaker trip unit settings and protective relay adjustments and tap settings shall be implemented on the equipment under study by the Independent Testing Organization.

3.04 ARC-FLASH HAZARD ANALYSIS

A. An arc-flash hazard analysis shall be performed in accordance with NFPA 70E and IEEE 1584. Arc-flash hazard analysis shall include:

1. Calculation of arc current in accordance with the applicable standards.

2. Determination of protective device total-clearing times based upon the time-current characteristics.

3. Calculation of arc-flash incident energy level based on the protective device total-clearing time and appropriate working distance.

4. Calculation of arc-flash protection boundary distance.

5. Shock hazard voltage and associated limited approach and restricted approach distances.

B. Determination of appropriate personnel protective equipment in accordance with risk levels defined in NFPA 70E.

C. Preparation of arc-flash and shock hazard warning labels, with the data derived from the hazard analysis, to be affixed to the equipment by the Independent Testing organization.

END OF SECTION

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SECTION 16010
GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 INCLUDED WORK

A. The General Conditions and Special Conditions form a part of these specifications.

B. The provisions of this section shall apply to the furnishing of all labor, materials, equipment and supervision to provide the complete electrical requirements necessary for the operation of the Storm Drain Pump Stations Electrical Upgrades of the City of Alameda. In general, the electrical equipment and installation shall include but is not limited to the following items:

1. Service Pedestal
2. Pump Control Panel
3. Pressure Level Transmitter
4. Underground conduits, and pullboxes
5. Low voltage power cables
6. Rigid steel and PVC coated rigid steel conduit system
7. Grounding system
8. Testing and system startup.

C. Additional requirements are also provided in specific technical sections of the project specifications. Conflicting provisions between this general electrical requirement section and specific section requirements shall be brought to the attention of the Engineer for proper resolution.

1.02 APPLICABLE PUBLICATIONS

A. The electrical equipment shall be manufactured, installed and tested in accordance with the latest edition of the following applicable standards:

1. AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)
   a. ANSI C2, National Electrical Safety Code
2. CALIFORNIA BUILDING STANDARDS COMMISSION
   a. California Electrical Code (CEC)
   b. California Building Code (CBC)
3. CODE OF FEDERAL REGULATIONS (CFR)
   a. 29 CFR 1910.147, Control of Hazardous Energy (Lock Out/Tag Out)
4. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)

a. IEEE 100, Dictionary of Electrical and Electronics Terms

5. INTERNATIONAL TESTING ASSOCIATION, INC

a. NETA ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems

6. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

a. NEMA ICS 1, General Standards for Industrial Control and Systems

b. MEMAS ICS 2, Industrial Control Devices, Controllers and Assemblies

c. NEMA ICS 4, Terminal Blocks for Industrial Use

d. NEMA ICS 6, Enclosures for Industrial Controls and Systems

7. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

a. NFPA 70E Standard for Electrical Safety in the Workplace

8. STATE OF CALIFORNIA PUBLIC UTILITIES COMMISSION

a. G.O. 128, Rules for Construction of Underground Electric Supply and Communication Systems

9. UNDERWRITTERS LABORATORIES (UL)

a. UL 50, Enclosure for Electrical Equipment

b. UL 508A, Standard for Industrial Control Panels

1.03 MODIFICATION OF REFERENCES

A. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, “shall” had been substituted for “should” wherever it appears.

1.04 DEFINITIONS

A. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

B. The technical sections referred to herein are those specification sections, within this electrical specification, that describe products, systems, installation procedures, equipment, operations, and test methods.

1.05 ELECTRICAL CHARACTERISTICS

A. The service equipment will consist of a metered service pedestal. The service pedestal shall be rated as indicated on the Drawings

1.06 SUBMITTALS

A. General

1. Submittals required in the technical sections which refer to this section shall conform to the following additional requirements. Submittals shall include the manufacturer’s name, trade name, place of manufacture,

catalog or model number, nameplate data, size, layout dimensions, capacity, project specification and technical paragraph reference. Submittals shall also include applicable industry, and technical society publication references, and years of satisfactory service, and other information necessary to establish contract compliance of each item to be provided. Photographs of existing installations are unacceptable and will be returned without approval.

B. Manufacturer's Catalog Data

1. Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts. Handwritten and typed modifications and other notations not part of the manufacturer's preprinted data will result in the rejection of the submittal. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as requested.

C. Drawings

1. Submit drawings a minimum of 11-inches by 17-inches in size using a minimum scale of ⅛-inch per foot. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

D. Instructions

1. Where installation procedures or part of the installation procedures are required to be in accordance with manufacturer's instructions, submit printed copies of those instructions prior to installation. Installation of the item shall not proceed until manufacturer's instructions are received. Failure to submit manufacturer's instructions shall be cause for rejection of the equipment or material.

E. Certificates

1. Submit manufacturer's certification as required for products, materials, finishes, and equipment as specified in the technical sections. Certificates from material suppliers are not acceptable. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certifications shall simply state that the item conforms to the requirements specified.

Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance.

1.07 REFERENCE STANDARD COMPLIANCE

A. Where equipment or materials are specified to conform to industry and technical society reference standards such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), Underwriters Laboratories Inc. (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

1.08 CODE COMPLIANCE

A. Code compliance is mandatory. Nothing in these Drawings and Specifications permits work not conforming to these codes. Where work is shown to exceed minimum code requirements, comply with Drawings and Specifications.

B. No work shall be concealed until after inspection and approval by proper authorities. If work is concealed without inspection and approval, the Contractor shall be responsible for all work required to open and restore the concealed areas in addition to all required modifications.

1.09 INDEPENDENT TESTING ORGANIZATION CERTIFICATE

A. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.10 QUALITY ASSURANCE

A. Material and Equipment Qualifications

1. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design, and workmanship. Products shall have been in satisfactory commercial or industrial use for 10 years prior to bid opening. The 10 year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 10-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacture; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

B. Regulatory Requirements

1. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of CEC.

C. Alternative Qualifications

1. Products having less than a 10-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 20,000 hours, exclusive of the manufacturer's factory or laboratory tests, is furnished.

1.11 SEISMIC ANCHOR DESIGN CALCULATIONS

A. Pump control panel, service cabinet and electrical materials shall be so installed as to remain in a secure and captive position when subjected to a horizontal force in accordance with the 2019 California Building Code for the areas where the equipment is to be installed. A seismic importance factor, corresponding to Essential Facility Occupancy Category, shall be used. Method of securing shall constrain equipment against both vertical and horizontal forces and overturning forces.

B. Calculations shall be submitted, prepared by a structural engineer registered in the State of California, of earthquakes forces on all specified equipment, details of securing devices, layout, location and size of all bolts, straps, clips or other devices used.

1.12 DRAWINGS AND SPECIFICATIONS

A. All drawings and all Divisions of these specifications shall be considered as a whole and work of this Division shown anywhere therein shall be furnished under this Division.

B. Drawings are diagrammatic and indicate the general arrangement of equipment and wiring. Most direct routing of conduits and wiring is not assured. Exact requirements shall be governed by civil, architectural, structural and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Extra lengths of wiring or addition of pull or junction boxes, etc. necessitated by such conditions shall be in the bid. Check all information and report any apparent discrepancies before submitting bid.

1.13 SERVICE SUPPORT

A. The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.14 SITE CONDITIONS

A. Visit to site is required of all bidders prior to submission of bid. All will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

1.15 EXISTING UTILITIES

A. When shown on the drawings, the locations of existing utility mains, etc. are approximate only. The accuracy of completeness of this information is not guaranteed and all utility lines, conduits etc. of any nature (surface or subsurface) that may be affected by the Work shall be checked by the Contractor and shall not be disturbed, disconnected or damaged by him during the progress of the Work, unless specifically shown on the plans to be relocated, removed or otherwise revised. Should the Contractor during the performance of the Work disturb, disconnect, or damage any of the above, all expenses of whatever nature arising from such disturbance or the replacement or repair thereof shall be borne by Contractor.

B. Carefully excavate all underground piping and conduit affected by the work and verify the elevations.

C. When it is necessary to interrupt any existing utility service to make connections, the Contractor shall obtain authorization from the City of Alameda and Alameda Municipal Power and a minimum of 24 hours advance notice shall be given to both organizations. Interruption in utility service shall be of the shortest duration for the work at hand and shall be approved by the City's Project Manager.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials and equipment used in the electrical work herein specified shall be new, suited to the intended use, and shall be listed by the Underwriters Laboratories, Inc., or other nationally recognized testing laboratories. All material and equipment shall meet their requirements and bear their label whenever standards have been established and label service is regularly furnished by that agency.

B. Materials shall be delivered to the site and stored in original containers suitably sheltered from the elements, but readily accessible for inspection by the City or his designated representative until installed. All items subject to moisture damage shall be stored in dry, heated spaces.

C. Materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.

D. Equipment specified by manufacturer's number shall include all accessories, control, etc., listing in catalog as standard with equipment. Furnish optional or additional accessories as specified.

E. Where no specified make of material or equipment is mentioned, any product of reputable manufacturer which conforms to requirements of system may be used.

2.02 ALTERNATE EQUIPMENT

A. If Contractor wishes to submit equipment other than as specified and submittal of equipment is found to be not acceptable, the specified equipment shall be furnished at no change in contract price. The decision of the Engineer shall be final.

B. If Contractor wishes to propose equipment that represents an extensive change in system concept, he shall reimburse the Agency for engineering charges required to analyze and evaluate these changes. These changes shall be paid by the Contractor regardless of whether the proposed equipment is accepted or not.

C. In the event that changes are made after submittal approval, Contractor shall revise the plans and resubmit for approval. Revised plans shall incorporate a dated revision note. Revision and resubmittal is required for any deviation between approved plans and the final installation regardless of the reason for the deviation. If the revised and resubmitted plans are not approved, Contractor shall modify the work to comply with approved plans at his expense.

2.03 MANUFACTURER'S NAMEPLATE

A. Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, shop order number, serial number and date of manufacture securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.

2.04 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Provide laminated plastic nameplates for pump control panel. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be phenolic, laminated, plastic, 0.125-inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 1 x 2.5-inches. Lettering shall be a minimum of 0.25-inch high normal block style.

2.05 CABLE TAGS IN HANDHOLES AND PULLBOXES

A. Provide tags for each cable, wire or splice located in handholes, and pullboxes. Tag all wire and cable provided by this contract. The tags shall be polyethylene. Do not provide handwritten letters. Coordinate cable legend with City's Representative.

B. Provide tags of polyethylene that have an average tensile strength of 4500 pounds per square inch; and that are 0.035-inch thick, non-corrosive, nonconductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 300 degrees F. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties shall have a minimum loop tensile strength of 175 pounds. The cable tags shall have block letters, numbers, and symbols

1/4-inch high on a yellow background. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.

C. Locate the tags so that they are clearly visible without disturbing cabling or wiring in the handholes and pullboxes.

PART 3 EXECUTION

3.01 PROTECTION OF PROPERTY, MATERIALS, AND WORK

A. The Contractor shall be responsible for protecting all properties of whatever description lying within the scope of the project from damage resulting from, or incidental to, this Contract. Likewise, the Contractor shall be obliged to pay for all such damage occurring during the progress of the work.

B. All materials and equipment, both before and after erection, shall be properly protected from the weather and other hazards and kept in a clean and orderly manner.

C. All conduit ends, and parts or equipment left unconnected shall be capped, plugged, or otherwise properly protected to prevent damage or the intrusion of foreign matter.

D. At the completion of the work, equipment and materials shall be cleaned and turned over to the City in a condition satisfactory to the City.

E. Damage or defects developing before acceptance of the work shall be replaced with new at the Contractor's expense.

F. Manufacturer's direction shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials.

3.02 STORED EQUIPMENT

A. Storage shall be located on the site in a location specifically approved by the City and shall be moved at Contractor's expense if necessary because of interference with the work of any other Contractor.

3.03 ALTERNATE EQUIPMENT PLACEMENT

A. Where equipment requiring a different arrangement of connections from those indicated is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with all trades with the intent of the Drawings and Specifications.

B. Where directed by the City or his designated representative, the Contractor shall submit drawings showing the proposed installation.

C. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, duct work, supports, insulation, wiring, etc. He shall provide all additional modifications and equipment required for the proper operation of

the system resulting from the selection of equipment, including all required changes in affected trades.

D. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the Contract amount or additional cost to the other trades.

3.04 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work, ready for use and operation by the City in the manner intended by the Contract Documents.

B. Provide services of an experienced superintendent who shall be constantly in charge of the erection of this work, together with all necessary journeymen, helpers, and laborers required to properly unload, erect, connect, adjust, start, operate and test functions properly in every detail.

C. At the time that any electrical system included under this Contract is released for operation to the City, the Contractor shall furnish a competent instructor to advise the maintenance and/or operating personnel as to the proper maintenance and operation of all components of the system.

D. The Contractor shall study thoroughly all Civil, Structural, Mechanical and Electrical Drawings, shop drawings and catalog data to determine how equipment is to be installed, fit the space available with proper access, mounted or suspended.

E. The Contractor shall promptly notify the City or his designated representative in writing of any conflict between any requirement of the Contract Documents and the manufacturer's directions before proceeding with the work.

F. Should the Contractor perform any work that does not comply with the manufacturer's directions or such written instructions from the City or his designated representative, he shall bear all costs arising in correcting the deficiencies. In the event the requirements of the manufacturer are different than those indicated on the Contract Drawings, such requirements shall be furnished by the Contractor at no additional cost to the City.

3.05 DISPOSAL OF EXCAVATED MATERIAL

A. The Contractor shall be responsible for the removal from the premises of all excess excavated materials unless otherwise directed by the City or his designated representatives.

3.06 RECORD DRAWINGS

A. The Contractor shall keep one set of plans to record all changes and deviations from the original design. These plans shall be used for no other purposes and shall be kept clean from all dirt and obstructions. All changes shall be made each day on the plans as they come about. Immediately upon final inspection

and acceptance by the City but before final payment, the Contractor shall deliver to the City the complete record drawings showing all the changes neatly and accurately arranged.

3.07 LOCKOUT REQUIREMENTS

A. Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147.

3.08 PAINTING OF EQUIPMENT

A. Factory Applied

1. Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the electrical sections.

B. Field Applied

1. Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in the section specifying the associated electrical equipment.

3.09 ACCEPTANCE DEMONSTRATION

A. Upon completion of the work, at a time to be designated by the City of Alameda, the Contractor shall demonstrate to the City the operation of the electrical installation, including any and all special items installed by him or installed under his supervision.

3.10 INSTRUCTIONS TO CITY'S OPERATIONS AND MAINTENANCE PERSONNEL

A. Contractor shall provide the services of competent instructors to give full instruction to designated City's personnel in the adjustment, operation, and maintenance of the below specified systems and equipment, including pertinent safety requirements as necessary for the safe, reliable and continuous operation of the pump control system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work associated with sewage pump station control systems.

B. Instruction shall be given during the first regular workweek after the equipment or systems have been accepted and turned over to the City for regular operation. The following systems and equipment shall require instruction to City's personnel:

1. Pump Station Control Panel.

C. The minimum number of man-days (8 hours per day) of instruction furnished for the above systems and equipment shall be as indicated in the equipment

specifications sections. Classroom instructions shall be at a City specified facility. Field instructions shall be at the pump stations project site.

3.11 PROJECT COMPLETION

A. The Contractor shall remove from the site all packing cartons, scrap materials, and other rubbish or debris and leave the premises in a condition acceptable to the City.

B. The Contractor shall, at completion of the project, leave the entire system installed under his contract properly operating, lubricated, and in a thoroughly clean condition.

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SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Furnish and install all materials and equipment and provide all labor required and necessary to complete the work shown on the Drawings and/or specified in this Section and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete installation including all accessories and appurtenances required for testing the system. It is the intent of the Drawings and Specifications that all systems be complete, and ready for operation.

1.02 APPLICABLE PUBLICATIONS

A. All work and materials shall comply with the latest edition of the standards, rules, codes, and regulations including, but not limited to the following:

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
    a. ASTM B3, Standard Specification for Soft Annealed Copper Wire
    b. ASTM B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium, or Soft
    c. ASTM B228, Standard Specification for Concentric-Lay-Stranded Copper Clad Steel Conductors
2. CALIFORNIA CODE OF REGULATIONS
    a. Title 24, Part 2, 2019 California Building Code
    b. Title 24, Part 3, 2019 California Electrical Code
3. ETL ENTERTEK
    a. ETL PVC001 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Conduit
4. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
    a. NEMA 250, Enclosures for Electric Equipment (1000 Volts Maximum)
    b. NEMA AB 1, Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures
    c. NEMA ICS 2, Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts
    d. NEMA FB 1, Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
    e. NEMA FU1, Low Voltage Cartridge Fuses
    f. NEMA RN 1, Polyvinyl -Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
    g. NEMA TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

h. NEMA TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

i. NEMA WC 70, Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

5. UNDERWRITER'S LABORATORIES, INC. (UL)

a. UL 6, Electrical Rigid Metal Conduit-Steel

b. UL 44, Thermoset-Insulated Wires and Cables

c. UL 83, Thermoplastic-Insulated Wires and Cables

d. UL 360, Standard for Liquid-Tight Flexible Metal Conduit

e. UL 467, Grounding and Bonding Equipment

f. UL 486 A, Wire Connectors

g. UL 486 C, Splicing Wiring Connectors

h. UL 508, Industrial Control Equipment

i. UL 514 B, Conduit, Tubing, and Cable Fittings

j. UL 651, Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

k. UL 943, Ground Fault Circuit Interrupters

1.03 SUBMITTALS

A. Product Data: Provide material, finish, dimensions and weights for rigid metal conduit, rigid nonmetallic conduit, fittings, boxes, conduit bodies, conductors, and grounding equipment.

PART 2 PRODUCTS

2.01 MATERIALS APPROVAL

A. All materials must be new and bear Underwriters' Laboratories label. Materials that are not covered by UL testing standards shall be tested and approved by an independent testing laboratory or a governmental agency.

B. Material not in accordance with these Specifications may be rejected either before or after installation.

2.02 CONDUITS AND OTHER RACEWAY

A. Rigid Steel Conduit

1. Rigid steel conduit shall comply with UL 6 and be galvanized by the hot-dip process.

2. Fittings for rigid steel conduit shall be threaded.

3. Gaskets shall be solid. Conduit fittings with blank covers shall have gaskets, except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

4. Covers shall have captive screws and be accessible after the work has been completed.

B. PVC Coated Rigid Steel Conduit

1. PVC coated conduit and all fittings consisting of galvanized rigid steel conduit meeting the requirements of NEMA RN 1, UL, ETL PVC-001, and the NEC. A PVC coating of 40 mils nominal thickness bonded to the metal in locations where conduit is exposed to corrosive conditions. Provide fittings with overlapping pressure sealing sleeves. Use PVC coated conduit suitable for conductors with 75 degrees C insulation. The interior surfaces of conduits and fittings shall be lined with corrosion resistant coating to a minimum thickness of 2 mils. The conduit clamps and other hardware used for installation of this type conduit shall be stainless steel.

2. A PVC coating shall be bonded to the outer surface of the conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 0.040-inch (40 mils). The PVC coating shall be painted red. Contractor shall submit written certification from PVC conduit manufacturer that the PVC contains UV resisting components to prevent decomposition of the PVC coating and/or separation of the PVC plasticizer under long-term exposure to sunlight.

3. A loose coupling shall be furnished with each length of conduit. A PVC coating shall be bonded to the outer surface of the coupling, and a PVC sleeve equal to the outside diameter of the uncoated conduit shall extend beyond both ends of the coupling approximately one pipe diameter or 1-1/2 inches, whichever is smaller. The wall thickness of the coating on the coupling and the sleeve shall be a minimum of 0.055-inch (55 mils). PVC touchup compound shall be used at all fitting connections to seal the system overlapping the female sleeve.

4. A PVC coating shall be bonded to the outer surface of all conduit bodies and fittings and a PVC sleeve shall extend from all hubs. The wall thickness of the coating on conduit bodies and fittings and the sleeve walls shall be identical on those on couplings in length and thickness. The covers on all conduit bodies shall be coated on both sides and shall be designed to be completely interchangeable.

5. Stainless steel screws and fasteners shall be furnished and used to fasten all items. All coated material shall be installed and patched holiday-free and according to the manufacturer's recommended installation and patching instructions. All repaired damage shall be reported to and approved by the Owner’s Representative.

6. Coating thickness of PVC coated fittings shall be the same as that for PVC coated conduits.

7. Approved Manufacturers

   a. Plasti-Bond

   b. Perma-Cote

   c. Korkap

C. Liquidtight Flexible Metal Conduit

1. Liquidtight flexible metal conduit shall comply with UL 360. Provide liquidtight flexible metallic conduit with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.

2. Specifically designed fittings for liquidtight flexible metallic conduit.

D. Sealing Fittings

1. Sealing fittings for Class I, Division 2 shall be provided where indicated on the Drawings. Sealing fittings shall be EY series for vertical or horizontal, 40 % Fill, as manufactured by Appleton, Crouse-Hinds, Killark or approved equivalent. Sealing fittings used with PVC coated rigid steel conduits shall also have the same PVC coating system as the PVC coated conduit system.

E. Rigid Nonmetallic conduit

1. Rigid nonmetallic conduit shall be in accordance with NEMA TC 2 and shall be PVC with wall thickness not less than Schedule 40. Conduit shall be approved for use as a nonmetallic raceway with 90 degree Centigrade conductors.

2. PVC Conduit Fittings shall be in accordance with NEMA TC 3.

2.03 MOUNTING AND SUPPORT CHANNELS

A. Channels shall be cold formed from prime pickled and oiled mild strip steel. Cross section of a single channel be 1-5/8 inches x 1-5/8 inches and cross section of a double channel shall be 1-5/8 inches x 3-1/4 inches. The channel wall thickness shall be 12 gauge.

B. Channels shall be hot-dipped galvanized after fabrication. Brackets, fittings and hardware shall be of the same material and finish.

C. Where specified and in wet well areas and outdoor location, channels shall be 12 Gauge, Type 304 stainless steel. Brackets, post bases, fittings and hardware shall also be of the same type stainless steel.

D. Fitted end caps shall be of non-metallic material and shall be made by the same manufacturer as the channels.

2.04 WARNING TAPE

A. Provide heavy-gauge, red plastic polyethylene tape of 6-inch width for use in trenches containing electric circuits. Utilize tape made of material resistant to corrosive soil. Use tape with black printed warning that an electric circuit is located below the tape. Seton Style No. 37236 or approved equal.

2.05 CONDUCTORS

A. All conductors shall be of size noted on the plans. All conductors shall be stranded copper type XHHW-2 insulation. Minimum size conductors shall be #12 AWG.

B. Wiring shall be color coded as follows:

Location or Use	Type	Color
For 240/120V, 1-Phase System	Phase A	Black
	Phase B	Red
	Neutral	White
	Ground	Green
For 240/120V, 3-Phase System and	Phase A	Black
For 208/120V, 3-Phase System	Phase B	Red *
	Phase C	Blue
	Neutral	White
	Ground	Green
For 480/277V, 3-Phase System	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow
	Neutral	Gray
	Ground	Green

*Provide Orange color wire for high leg conductor

C. Wires that are #10 AWG and smaller shall be color-coded over the entire length of the wire. Wires that are #8 AWG and larger may be color-coded with PVC tape that covers at least 50% of the length of the wire that is visually accessible in pull boxes, service pedestal, pump control panel, and similar places.

D. Wires for control and instrumentation shall be #14 AWG, 600 V, stranded copper, type XHHW-2, unless a larger wire size is indicated on the Plans.

E. Wire for analog signal circuits shall be twisted shielded pair, #16 AWG, 600 V insulation, stranded copper wire.

2.06 TERMINALS AND SPLICING DEVICES

A. Only compression type terminals shall be used for stranded conductors. Where equipment to which it is to connect has box type terminal lugs, no separate lug

will be required.

B. Make all splices in AWG No. 8 and smaller with twist-on insulated type wire nut electrical connector.

C. Make all splices in AWG No. 6 and larger with compression type connectors. Joints shall be insulated with heavy wall, heat shrink, sealant coated tubing, UL Listed for use with compression connectors.

D. Submersible splices shall be as manufactured by NSI Industries Polaris Black Series or approved equal. Provide ferrules for extra flexible, thin strand pump cables.

2.07 GROUNDING

A. Grounding electrode system cables shall be medium drawn, bare copper cables, concentric-stranded, in accordance with ASTM B8. The solid wires used in forming the cable shall be in accordance with ASTM B3.

B. Ground cable taps and connections shall be made with exothermic type welded connections. Exothermic welded connections shall be specifically designed for the conductor sizes to be used and shall be manufactured by Caldweld or approved equal.

C. All cable fittings, lugs, clamps and connectors, together with bolts, nuts and washers used therewith, shall be of copper alloy, solderless type and shall have current-carrying capacity not less than that of the copper cables with which they are used. The connectors shall be clamped firmly and locked securely with spring-type lock washers.

D. All machine screws used in grounding shall be corrosion resistant, stainless steel, bronze or brass.

E. Ground rods shall be cone pointed copper-clad steel, conforming to ASTM B228, ¾" diameter by 10 feet long, unless otherwise indicated on the Drawings.

F. Ground rod boxes shall be 9 inch diameter, 12 inches deep, precast concrete unit, with cast iron traffic cover. Covers shall be embossed with the words "Ground Rod".

G. Equipment grounding conductor shall be insulated and of the same type as the power carrying conductors.

2.08 SWITCHES

A. Toggle Switches

1. Toggle switches shall comply with MEMA WD 1, and be of the heavy duty, general purpose type.

2. Toggle switches shall be industrial grade toggle type, single-pole or three-way or four-way, two-position devices rated 20 amperes at 277 volts, 60 hertz alternating current (ac) only.

3. All toggle switches shall be products of the same manufacturer.

2.09 RECEPTACLES

A. Receptacles shall be industrial grade, 20A, 125 VAC, 2-pole, 3-wire duplex conforming to NEMA WD 1 and WD 6, NEMA 5-20R.

B. Provide all other special purpose receptacles, NEMA configuration as indicated on the Plans.

C. Provide ground fault circuit interrupter receptacles (GFCI) where indicated on the Plans. GFCI receptacles shall be UL Standard class A, non feed-through design.

D. Provide generator receptacle, 600V, 200A, Pin and Sleeve, Reverse Feed, Style 1, 4-Wire, 4-Pole, with mounting box, angle adapter and matching plug as indicated on the Drawings. Receptacle shall be “Appleton” Powertite or Crouse-Hinds equivalent.

2.10 DEVICE PLATES

A. Device plates shall be stainless steel Type 302 specifically designed for the outlet box and receptacles to which it is attached. Manufacturers: Leviton, Hubbell, Thomas & Betts or Pass & Seymour.

2.11 PULL BOXES AND JUNCTION BOXES

A. Pull Boxes and Junction Boxes shall be hinged cover, NEMA Type 4, of the sizes indicated on the Drawings. Boxes shall be fabricated from mild steel, minimum 16 gauge steel. Finish shall be ANSI 61 gray polyester powder paint finish inside and out.

B. Stainless steel pull boxes and junction boxes shall be Type 316L stainless steel, NEMA 4X, 16 gauge box body, 14 gauge hinged door with quarter turn latches and with padlocking provisions where indicated on the Contract Drawings.

PART 3 EXECUTION

3.01 GENERAL

A. Electrical system layouts indicated on the Drawings are generally diagrammatic, but shall be followed as closely as actual construction and work of the trades will permit. Govern exact routing of conduit and wiring and the locations of devices by the structure and equipment served.

B. Conduit runs between boxes, devices or equipment shall not contain more than the equivalent of three 90-degree bends.

C. Do not install crushed or deformed conduit. Avoid trapped conduit runs where possible. Take care to prevent the lodgment of foreign material in the conduit,

boxes, fittings, and equipment during the course of construction. Clear any clogged conduit of obstructions or be replaced.

1. Rigid Steel Conduit

    a. Make field-made bends and offsets with approved hickey or conduit bending machine. Conduit elbows larger than 2-1/2 inches shall be long radius.

    b. Provide all conduit stubbed-up through concrete floors for connections to free-standing equipment and other such items of equipment, with a flush coupling. Conduits installed for future use shall be terminated with a coupling and plug set flush with the floor.

2. PVC Coated Rigid Steel Conduit

    a. Install in strict accordance with the manufacturer's instructions. Those installing PVC Coated Rigid Steel Conduits must be certified by the manufacturer and be able to present a valid, unexpired certified installer card. Touch up any damage to the coating with conduit manufacturer acceptable touchup compound. Leave no metallic threads uncovered.

3. Liquidtight Flexible Metallic Conduit

    a. Bonding wires shall be used in liquidtight flexible conduit as specified in 2019 CEC, for all circuits. Liquidtight flexible conduit shall not be considered a ground conductor.

    b. Liquidtight flexible metallic conduit shall be used in wet and oily locations and to complete the connection to motor-driven equipment.

4. Rigid Nonmetallic Conduit

    a. Rigid PVC conduit shall be direct buried in trench, encased in a sand bedding, or concrete encased as indicated on the Drawings. Trench backfill shall be native material or controlled density fill (CDF).

    b. A green insulated copper grounding conductor shall be in conduit with conductors and be solidly connected to ground at each end. Grounding wires shall be sized in accordance with 2019 CEC.

5. Sealing Fittings

    a. Where required in hazardous areas, sealing fittings shall be installed in conduit system with an approved system of fiber-damming material and poured sealing compound.

3.02 WIRING METHOD

A. Conduit

1. All conduits shall be sized per CEC Table 4, ¾-inch minimum or larger, as noted on the Drawings, and shall be of types listed below:

Location or Use	Type
Underground Conduits	PVC Schedule 40
Underground and Above Ground Conduits for Golf Course Pump Station	PVC Coated Rigid Steel
Conduits in Dry Well	Rigid Steel
Conduits Outdoors, Above Ground	Rigid Steel

2. Run all conduits concealed unless otherwise noted or shown.
3. Run exposed conduit parallel to or at right angles to center lines of equipment.
4. Run no conduit in concrete slabs or floors except where indicated on the Drawings. All penetrations shall be at right angles to wall and slab surfaces.
5. Support conduits with UL's listed steel conduit supports at intervals required by the CEC.

3.03 INSTALLATION OF WIRES

A. Pull no wire into any portion of the conduit system until all construction work which might damage the wire has been completed.

B. Install all wire continuous from equipment to equipment. Splices in cables, when required, shall be made in handholes, pull boxes or junction boxes.

C. All control and instrumentation wiring shall be connected to equipment with insulated, compression type ring tongue terminations. All conductors shall be identified with a wire name as shown on the Drawings or as designated by equipment manufacturer. Wire identification shall be of the heat shrink type, installed at both wire ends.

D. Perform wiring insulation tests in accordance with NETA ATS testing guidelines.

E. Install Class I, Div 2 sealing fittings at all power, control and instrumentation conduits interfacing with the wet well equipment.

3.04 MOUNTING AND SUPPORT CHANNELS

A. Channels shall be used for mounting equipment to walls and for supporting conduit runs. Double channel type shall be used for fabricating equipment mounting racks as required or as detailed on the Drawings. All field cut surfaces of the channels shall be covered with matching zinc paint.

B. All ends of channels shall be fitted with end covers to prevent personnel injury.

3.05 GROUNDING

A. Contractor shall provide a grounding electrode system as shown on the Drawings and in accordance with CEC Article 250.50. Separately derived

alternating current systems shall be grounded in accordance with CEC Article 250.30.

B. Ground non-current carrying metal parts of electrical equipment enclosures, frames, conductor raceways, to provide a low impedance path for line-to-ground fault current and to bond all non-current carrying metal parts together.

C. Equipment grounding conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size equipment grounding conductors per CEC Article 250.122 unless larger conductors are shown on drawings.

D. Perform test to measure the ground resistance of the ground system. Submit certified test report to the engineer for review and approval. Ground resistance tests shall be conducted by a testing company qualified to conduct tests of this nature.

3.06 SWITHES AND RECEPTACLES

A. Light Switches and Receptacles

1. Light switches and Receptacles shall be installed at locations indicated on the Drawings.

2. Generator receptacle shall be installed by Service Pedestal manufacturer on the side of the enclosure or by the installing contractor on a stanchion or on structure wall as indicated on the Drawings.

3.07 PULL BOXES AND JUNCTION BOXES

A. Pull boxes and junction boxes installed on structure walls shall be supported on steel channels attached to wall with stainless steel inserts, minimum of 3/8” diameter x 3-1/2” embedment. Provide stainless steel channel supports for stainless steel boxes.

B. See Drawings for other pull boxes and junction boxes installation requirements.

3.08 IDENTIFICATION

A. Provide a phenolic nameplate for generator receptacle, junction and pull boxes, service pedestal, pump control panel, and for other major items of electrical equipment. Secure nameplate to equipment with stainless steel screws. For pump control panel, indicate the equipment designation, voltage, current, number of phases, and wires and the source of power. For all other equipment and cabinets provide engraving as shown on the Drawings or as directed by the City’s representative.

END OF SECTION

SECTION 16080

ELECTRICAL ACCEPTANCE TESTING

PART 1 GENERAL

1.01 SCOPE

A. Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Provide electrical testing to assure that electrical equipment and wiring is operational, within industry and manufacturers tolerances and is installed in accordance with other sections of these specifications.

C. Conduct tests in the presence of the City for the purpose of demonstrating the equipment or systems' compliance with specifications. Demonstrate all electrical and mechanical tests to the City that the entire installation is functioning properly and that all circuits, including power, control, instrumentation, relaying and communication, will function properly and as specified.

D. Furnish, install and maintain all tools, instruments, material, test equipment, test connections and power. Furnish all personnel including supervision and "stand-by" labor required for the testing, setting, and adjusting of all electrical facilities and component parts including putting the electrical system and equipment into operation.

E. Make tests with proper regard for the protection of equipment and personnel.

F. Protect equipment from subsequent testing of other equipment and systems after equipment has been tested, checked for operation, and accepted by the City.

G. Record all test values of equipment, giving both "as-found" and "as-left" conditions.

H. The witnessing of any test by the City does not relieve the Contractor of warranties for material, equipment, and workmanship, as specified in the General Conditions.

I. Check control circuits for conformance with the wiring diagrams furnished by manufacturers.

1.02 RELATED SECTIONS

A. Section 16401 Service Panel

B. Section 16901 Pump Control Panel

1.03 REFERENCE STANDARDS

A. All inspections and tests shall be performed in accordance with applicable codes and standards including 2019 CEC, ANSI, IEEE, NFPA, NEMA, and OSHA.

B. InterNational Electrical Testing Association (NETA)

ATS	Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, latest edition.

1.04 QUALIFICATIONS FOR INDEPENDENT TESTING ORGANIZATION

A. The Contractor shall engage the services of a qualified independent testing organization to provide final inspection, testing, calibration, and adjusting on the electrical distribution system as defined in this contract. The independent testing organization shall have been engaged in full practice for a minimum of five years. The organization shall be corporately and financially independent of the supplier, producer, or installer of the equipment.

B. The independent testing organization shall have a calibration program with accuracy traceable every six months, and in an unbroken chain, to the National Institute of Standards and Technology (N.I.S.T.).

C. The independent testing organization shall have a designated safety representative on the project. The safety standards shall include OSHA and NFPA 70E.

D. Testing, inspection, and calibration shall be performed by an Engineering Technician, certified by a national organization, with a minimum of 5 years experience inspecting, testing, and calibrating electrical distribution equipment, systems, and devices.

E. The Contractor shall supply to the independent testing organization complete sets of approved shop drawings, coordination study, settings of all adjustable devices, and other information necessary for an accurate inspection and evaluation of the system prior to the performance of any tests.

1.05 SUBMITTALS

A. Submit a copy of this specification section with addenda updates and all referenced sections with addenda updates as the first item of the submittal. Place a bold word "Comply" next to each paragraph to indicate that the paragraph will be complied with. Place a bold word "Deviate" next to each paragraph to which deviations will be proposed. Provide an explanation on the same page for each proposed deviation. Submittal made without this marked specification section(s) will be returned without review.

B. Bound copies of the certified test reports shall be submitted to the Owner as soon as possible after the completion of the electrical work. The final report shall be signed and include the following information:

1. Summary of the project.

2. Description of the equipment tested.

3. Visual inspection report.

4. Description of the tests.

5. Test results.

6. Conclusions and recommendations.

7. Appendix including appropriate test forms.

8. Identification of the test equipment used.

C. The qualifications of the independent testing organization shall be submitted to the Owner for approval prior to the start of testing. Full membership in the InterNational Electrical Testing association is a minimum requirement for qualification.

D. The qualifications of the Certified Engineering Technician shall be submitted to the Owner for approval prior to the start of work.

E. After the evaluation of the system and equipment has been made, the independent testing organization shall submit for approval an acceptance test procedure for each item of electrical distribution equipment to be tested on this project. Test procedures shall include the proposed system function test. No testing shall be performed until the test procedures have been approved.

PART 2 PRODUCTS

2.01 MATERIALS AND TEST EQUIPMENT

A. The independent testing organization shall provide all materials and equipment necessary to perform the inspections and tests.

PART 3 EXECUTION

3.01 GENERAL TESTING REQUIREMENTS

A. Test all parts of the electrical work including all electrical conductors for proper phasing, continuity, shorts, and grounds, prior to placing in service. Test for proper operating of all equipment functions, including alarm and indication functions.

B. Furnish labor, instruments, products, temporary power, and sufficient fuel as required for tests.

C. Correct deficiencies found as a result of tests and make replacements or repairs to tested products which are damaged as the result of the tests.

D. Schedule tests at a time convenient to witness thereto or persons affected by the tests.

E. Where specified, give written notification to the Owner for test procedures prior to the test.

F. Check control, instrumentation, and power cables and conductors for proper connections, workmanship and identification.

G. Check motors for correct rotation prior to operating equipment driven by any motor.

H. Verify that equipment has been lubricated before operating during motor test procedures.

I. Upon completion of the electrical work, recheck the following electrical connections: cable to bus, cable to panels, bus to bus and also throughout the job for tightness. Re-torque to manufacturers printed specifications where torque is less than the recommended value.

J. Make records of all tests in a neat and legible form. Identify the equipment or system tested and the test data.

K. Additional tests required shall be as outlined under the various Sections of these electrical specifications.

3.02 INSPECTION

A. A visual inspection of the installed equipment shall be performed by the independent testing organization to verify that the equipment installed and to be tested is the equipment denoted on the approved shop drawings. The inspection shall check the equipment designations, device characteristics, special installation requirements, applicable codes and standards.

B. After completion of the visual inspection, a report shall be developed stating any discrepancies that may have been found.

3.03 TESTING, CALIBRATION AND ADJUSTMENT

A. The independent testing organization shall perform tests on each item of equipment contained in this contract in accordance with the latest edition of the InterNational Electrical Testing Association's (NETA) “Acceptance Testing Specification for Electrical Power Equipment and Systems”, and the requirements of this specification.

B. Field Acceptance Testing shall be accomplished on each item of electrical equipment installed or connected to a part of this contract. This shall include:

1. Control Panel per NETA ATS Section 7.6 for circuit breakers, and Section 7.16.1.2 for starters

2. Circuit breakers per NETA ATS Section 7.6.1.1

3. Instrument transformers per NETA ATS Section 7.10

4. Surge protection devices per NETA ATS Section 7.19.1

5. AC Induction Motors (including pump motors) per NTA ATS Section 7.15.1

6. Low voltage cables, terminations, splices, joints, and connectors Per NETA ATS Section 7.3.2

7. Grounding system Per NETA ATS Section 7.13

8. Power Failure Relay. Perform simulation of power conditions to verify proper operation of the relay and the time delay characteristics. Simulation shall include phase loss and undervoltage for each phase, and phase reversal.

9. Thermal Scan. Infrared scan or survey shall be made and photographed with the equipment loaded at least 25 percent of the rated full load value. Thermal scan shall be conducted for the following equipment:

   a. Service Pedestal

   b. Pump Control Panel

   c. Panelboard

C. Systems shall be energized or otherwise placed in service only after completion of all required tests and an evaluation of the test results have been completed.

3.04 SYSTEM FUNCTION TESTS

A. Each system provided in this contract and covered by this section of specifications shall be function tested to ensure total system operation.

B. Upon satisfactory completion of equipment acceptance tests, the system functional tests shall be performed. It is the intent of System Function Tests to provide the proper interaction of all sensing, processing and action devices to effect the designed end product or result.

C. Implementation

1. The testing firm shall develop test parameters for the purpose of evaluating performance of all integral components and their functioning as a complete unit within design requirements.

2. Test all interlock safety devices for fail-safe functions in addition to design function.

3. The testing firm shall propose methods to initiate the sensing devices.

4. The testing firm shall note the operation of all alarms and indicating devices.

3.05 CORRECTION OF DEFICIENCIES

A. Any deficiencies found shall be rectified, and work affected by such deficiencies shall be completely retested at the Contractor's expense. Final acceptance of the electrical power and control system is contingent upon satisfactory completion of the acceptance and system function tests.

END OF SECTION

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SECTION 16380
UNDERGROUND DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

A. The work covered in this section consists of furnishing all labor, supervision, tools, materials, equipment and performing all work necessary to furnish and install a complete underground distribution system, including underground conduits and precast concrete pullboxes, as indicated on the Drawings and as specified herein.

1.02 APPLICABLE PUBLICATIONS

A. All work and materials shall comply with the latest edition of the standards, rules, codes, and regulations including, but not limited to the following:

1. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
    a. Standard Specifications for Highway Bridges
2. AMERICAN CONCRETE INSTITUTE (ACI)
    a. ACI 318, Building Code Requirements for Structural Concrete
3. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
    a. ANSI C2, National Electrical Safety Code
4. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
    a. ASTM A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
    b. ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
    c. ASTM C33, Standard Specification for Concrete Aggregates
    d. ASTM C150, Standard Specification for Portland Cement

1.03 SUBMITTALS

A. Manufacturer's Data and Shop Drawings: Provide catalog data and shop drawings for all the precast pullboxes sizes, including metal covers.

B. Submit manufacturer's statement certifying that the products supplied meet specified requirements.

C. Submit and obtain approval from Alameda Municipal Power (AMP) for all material used in connection to the service to the pump station, starting from the point of connection to the meter pedestal. Contractor shall copy the City on all correspondence and submittals to Alameda Municipal Power.

PART 2 PRODUCTS

2.01 PRECAST PULLBOXES

A. General

1. The Contractor shall provide precast concrete pullboxes, subject to the requirements as shown on the Drawings and specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast pullboxes.

B. Concrete Structure

1. Concrete for precast work shall have an ultimate 28-day compressive strength of not less than 4,000 psi. Structures shall be precast to the size and details indicated on the drawings. Precast pullboxes shall be fabricated monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded or in otherwise permanently attached to an interior wall face.

C. Covers

1. Covers for pullboxes shall be fabricated of steel, welded by qualified welders in accordance with standard commercial practice. Steel covers shall be rated AASHTO H-20. Frames for pullboxes of interior dimensions, 3 ft x 5 ft, and larger shall have removable full traffic cover support beams. Precast pullbox covers shall be secured to the frame with minimum 7/16" diameter coarse threaded pentahead bolts having approximately 6 threads per inch.

D. Grounding

1. Provide a 3/4-inch diameter, 10-feet long copper-clad ground rod at each handhole, pullbox and splice box.

E. Duct Seal

1. Provide duct seals wherever underground conduits enter an equipment enclosure to prevent water or moisture from entering the equipment enclosure through the conduit. Duct seals shall be compatible with plastic and steel ducts and shall provide a watertight duct seal regardless of whether the duct is empty or occupied by cables. Duct seals shall allow for cable movement due to vibration or load cycling without leaking. Ducts shall be sealed at both the pullbox and at the equipment end.

2.02 UNDERGROUND CONDUIT SYSTEM

A. Underground conduits system shall be PVC Schedule 40, or rigid steel PVC coated, as specified in Section 16050 of this specification.

PART 3 EXECUTION

3.01 UNDERGROUND INSTALLATION

A. General

1. Underground installation shall conform to the 2019 CEC, ANSI C2 and State of California Public Utilities Commission G.O. 128

3.02 PRECAST PULLBOXES INSTALLATION

A. Commercial precast assembly shall be set on 9-inches of level, 90% compacted granular fill, 1-inch to 2-inch size, extending 12-inches beyond the pullbox on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator.

3.03 CONDUIT PLACEMENT

A. Conduit shall have a continuous slope toward underground structures and away from the electrical equipment with a minimum pitch of 3-inches in 100-feet. Except at conduit risers, accomplish changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends. Sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 24-inches for use with conduits 3-inches in diameter and larger. Excavate trenches along straight lines from structure to structure before ducts are laid or structure constructed so the elevations can be adjusted, if necessary, to avoid unseen obstruction.

B. Terminate PVC conduits in end-bells where conduit enters underground structures. As each section of conduit is completed from structure to structure, conduits shall be cleaned and provided with end plugs to prevent dirt and debris from entering the ducts. For conduit sizes 3-inches and larger, cleaning shall consist of drawing a flexible testing mandrel, approximately 12-inches long with diameter less that the diameter of conduit, through the duct. Following the mandrel, draw a stiff bristle brush, having the same diameter as the conduit through the duct until duct is clear of particles of earth, sand, and gravel, then immediately install end plugs. For conduit sizes less than 3-inches, draw a stiff bristle brush through the conduit, until conduit is clear of particles of earth, sand, and gravel, then immediately install end plugs.

3.04 CONDUIT PLUGS AND PULL ROPE

A. Conduit not used or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3-feet of slack at each end of unused or empty conduits.

3.05 CABLE PULLING

A. Test duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the handhole, pullbox, or equipment of the highest elevation. Use flexible cable feeds to convey cables through handhole or pullbox openings and into duct runs. Accumulate cable slack at each handhole or pullbox where space permits by training cable around the interior to form one complete loop. Maintain minimum allowable bending radii in forming such loops. Do not provide less than the specified cable bending radii when installing cable under any conditions, including turnups into pump control panel, and other enclosures. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.06 CABLE LUBRICANTS

A. Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables. Lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.

3.07 CABLE PULLING TENSIONS

A. Tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer. Monitor pulling tension during cable installation to ensure maximum pulling tension is not exceeded.

3.08 GROUNDING CONDUCTOR

A. Provide insulated copper equipment grounding conductor, sized as indicated or required by the rating of the overcurrent device supplying the phase conductors, per NEC.

3.09 CABLES IN PULLBOXES

A. Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths.

3.10 FIELD TESTING

A. Field testing shall be provided for all cables, and grounding system in accordance with NETA ATS.

END OF SECTION

SECTION 16401
SERVICE PEDESTAL

PART 1 GENERAL

1.01 WORK INCLUDED

A. This specification covers the equipment and services necessary for the design, manufacture, factory testing, installation, and field testing of a complete and operable service pedestal in full compliance with the serving electrical utility company requirements. Service pedestal voltage, number of phases, and ampacity shall be as indicated on the Drawings.

1.02 APPLICABLE STANDARDS

A. The Service Pedestal and all accessory equipment shall be designed, manufactured and tested in accordance with the following applicable standards:

1. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
    a. AB-1, Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures
2. UNDERWRITTERS LABORATORIES INC. (UL)
    a. UL-508, Industrial Control Equipment
    b. UL-508A, Industrial Control Panels
3. CALIFORNIA CODE OF REGULATIONS (CCR):
    a. Title 24, Part 3, 2019 California Electrical code (CEC)
4. ALAMEDA MUNICIPAL POWER (AMP)
    a. Conform to utility company metering requirements

1.03 SUBMITTALS

A. Manufacturer shall furnish submittals containing the following information for Alameda Municipal Power approval:

1. Manufacturer’s literature describing the product.
2. Catalog Data of all circuit breakers, listing interrupting rating and trip functions provided.
3. Manufacturer’s Shop Drawings
    a. Shop drawings of service pedestal indicating the enclosure’s overall dimensions, floor plan, elevation and top view, metering section details, arrangement of circuit breakers, schematic diagram, and nameplate schedule.
    b. Contractor shall submit anchorage details and calculations, signed and stamped by a Civil or Structural Engineer, to the City’s

Building Department for their review and approval. Contractor shall copy the City on all correspondence and submittals with the Building Department.

B. Contractor shall coordinate all submittal information with Alameda Municipal Power and shall copy the City on all correspondence and submittal information.

PART 2 PRODUCTS

2.01 GENERAL

A. The service pedestal shall have a voltage rating as indicated on the Plans and shall be UL listed for service entrance application. Manufacturer shall coordinate metering requirements with the serving utility company.

B. Manufacturers

1. The following manufacturers and equipment suppliers are approved, provided they meet the specifications and requirements listed herein.

a. Tesco

2.02 SERVICE PEDESTAL CONSTRUCTION

A. General

1. The service pedestal shall house the utility service main circuit breaker. The main circuit breaker, and all wiring, shall be located behind an interior dead front door or panel. Where indicated on the Drawings, provide a mechanically interlock generator receptacle breaker.

B. Enclosure

1. The service pedestal assembly shall be 50 inch high, UL listed weatherproof NEMA 3R switchboard and instrument pedestal. Enclosure shall be similar to a TESCO Class 27-000 section with dead front interior and hinged gasketed exterior doors. Outer enclosure shall be constructed of 12 gauge hot dipped galvanized steel. Doors shall be equipped with hasps and staples for City's padlocks. Where indicated on the Drawings, enclosure shall be 316 stainless steel, NEMA 3RX.

C. Circuit Breaker

1. Main circuit breaker and Generator Receptacle circuit breaker shall have interrupting capacities of not less than 25,000 amperes or higher interrupting rating as indicated on the Drawings. Circuit breaker shall be of the indicating type, providing ON, OFF and TRIPPED positions of the operating handle. Circuit breaker shall be quick-make, quick-break, with a thermal-magnetic action. Circuit breaker shall be the bolted on type, and shall be designed so that an overload on one pole automatically causes all poles to open. Circuit breakers shall meet the requirements of UL and NEMA AB 1. Provide mechanical interlock

between the main circuit breaker and the generator receptacle circuit breaker, such that only one of the breakers can be closed at a time.

D. Ground Bus

1. The service pedestal ground bus and incoming neutral service conductor shall be connected to a "rod" type "ground". The ground rod shall be 3/4" x 10' copper clad with connection made by exothermic weld and driven in earth at base of pedestal. The ground rod shall extend up into the service pedestal for visible connection with an approved "exothermic weld". Grounding and bonding wires shall be installed in all PVC conduit runs and connected to ground bus.

2. Grounding conductor - All grounding conductor shall be sized as shown on the Drawings or in accordance with the CEC, whichever is larger.

3. Ground bus - A ground bus shall be provided in the service equipment. It shall be connected to the grounding electrode system by exothermic welded stranded copper grounding conductors. Screw type lugs shall be provided for connection of equipment grounding conductors.

E. Utility Meter

1. The electric service meter compartment shall be arranged approximately as shown to meet the electric utility company and EUSERC requirements. Provide neutral bar for grounding. Provide guard over power company watt hour meter with hinged access cover that has a hasp for utility company padlock. Provide wire and lugs for service entrance as required by utility company. The pull section and utility compartments shall be accessible only by the utility company. A lightning arrestor shall be provided to protect the panel equipment from lightning and utility power surges. Provide a meter base, test perch with test by-pass and other materials, as required by the electric utility which will provide service to the facility, for installation of metering equipment and attachment of service conductors.

F. Nameplates

1. Provide individual nameplates for each of the circuit breakers on the service pedestal. Nameplates shall be phenolic type with white characters on black background.

G. Enclosure Finish

1. Finish shall be polyester dry powder, electrostatically applied and baked on at 380 deg. F. Color of interior door and mounting plate shall be white. Color of enclosure exterior shall be light grey. Provide color chip samples to the City for approval. The painting process shall include five stages of metal preparation using dip tanks as follows:

a. Alkaline cleaner

b. Clear water rinse

c. Iron phosphate application

d. Clear water rinse

e. Inhibitive rinse to seal phosphated surfaces.

H. Anchoring Details

1. Service pedestal manufacturer shall provide anchoring details for mounting service pedestal on a concrete pad.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. Service pedestal shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete service pedestal shall be tested for operation under simulated service conditions to assure accuracy of the wiring and function of the equipment. Certified copies of factory test reports shall be provided.

3.02 INSTALLATION

A. The service pedestal shall be installed in accordance with manufacturer's instructions at the location shown on the Drawings.

B. Contractor shall provide all labor and material to cast in place concrete pad and to anchor the service pedestal to the concrete pad.

END OF SECTION

SECTION 16901
PUMP CONTROL PANEL

PART 1 GENERAL

1.01 WORK INCLUDED

A. The work covered in this section consists of furnishing all labor, supervision, tools, materials, equipment, testing and performing all work necessary to furnish and install an outdoor pump control panel (Motor Control Center) as indicated on the Drawings. The pump control panel shall be completely constructed and pre-wired at the factory of the manufacturer. No part of its construction is to be performed or wiring completed at the job site or during installation.

B. The pump control panel shall include motor feeder circuit breakers, power monitoring relay, surge suppression device, motor starters, motor monitoring, HOA selector switches, toggle switches, indicating lights, elapse time meters, step-down power transformer, control power transformers, pump controller, intrinsically safe relays, zener barriers, 120 VAC uninterruptible power supply (UPS), 24VDC power supply, anti-condensation space heaters, ventilating fans, and all other devices required for a complete and operational system.

C. Space shall be provided on the pump control panel for the installation of the City's RTU equipment. Contractor shall perform the installation and wiring of this equipment under the supervision of Thunderbird Communications, the City's SCADA Contractor. Thunderbird Communications will perform the programming and commissioning of the SCADA system.

1.02 APPLICABLE STANDARDS

A. The pump control panel shall be designed, manufactured and tested in accordance with the latest edition of the standards and publications listed below:

1. INTERNATIONAL TESTING ASSOCIATION (NETA)
    a. NETA-ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
2. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
    a. AB 1, Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures
    b. ICS-1, Industrial Control and Systems: General Requirements
    c. ICS-2, Controllers, Contactors and Overload Relays Rated 600 V
    d. ICS-4, Application Guideline for Terminal Blocks
    e. ICS-6, Industrial Control and Systems: Enclosures

f. UNDERWRITERS LABORATORIES, INC. (UL)

g. UL 486A, Wire Connectors

h. UL 508, Industrial Control Equipment

i. UL 508A, Industrial Control Panels

1.03 SUBMITTALS

A. Supplier shall furnish a submittal containing the following information for City's approval:

1. Descriptive Bulletins and catalog information of all equipment and devices provided with the pump control panel.
2. Product Data Sheets of all equipment and devices provided with the pump control panel.
3. Shop drawings submittal shall include:
   a. Front view and elevation
   b. Floor plan
   c. Top view
   d. Assembly ratings, including voltage, continuous current and short circuit current rating
   e. Single line diagram
   f. Control diagrams
   g. Nameplate schedule
   h. Conduit entry/exit locations
   i. Anchorage detail and calculations, signed and stamped by a Civil or Structural Engineer. Contractor shall submit panel anchorage detail and calculations to the City Building Department for their review and approval. Contractor shall copy the City with all correspondence and submittals to the Building Department.
4. Component Schedule Bill of Material, including voltage, continuous current and interrupting ratings:
   a. Circuit breakers, power monitoring relay, surge suppression device, step-down power transformer, control power transformers, 120 VAC uninterrruptible power supply (UPS), 24 VDC power supply, reduced voltage soft starters, pump controller equipment, level controller system, pump alternating relay, intrinsically safe relays and zener barriers, interposing relays, timing relays, selectors switches, toggle switches, push buttons, pilot lights, elapse time meters, terminal blocks, space heaters, and ventilating fans.
5. Cable terminal lugs sizes
6. Equipment seismic certification

7. Installation information
8. Operations and Maintenance Manual, including:
    a. General description.
    b. Description of all control functions.
    c. Programming documentation of the level controller system.
    d. Programming documentation of the reduced voltage soft starter settings, protection, and metering parameters.
    e. Performance data and technical data.
    f. Catalog information of all equipment and devices used in the pump control panel.
    g. Operating and Maintenance Procedures.
    h. A complete set of as-built drawings, including one-line diagrams, schematic diagrams, wiring diagrams, plan views, elevations and details.
    i. Certified copy of test reports.
    j. Recommended renewal parts list.

1.04 QUALIFICATIONS

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. A list of installations with similar equipment shall be provided to demonstrate compliance with this requirement.

B. The pump control panel shall be suitable for and certified to meet all applicable seismic requirements of the 2019 California Building Code (CBC) for the project areas. Guidelines for the installation consistent with these requirements shall be provided by the pump control panel manufacturer and be based upon testing of representative equipment. Panel manufacturer shall also provide Arc Flash label for the completed panel assembly in accordance with NFPA 70E.

PART 2 PRODUCT

2.01 GENERAL

A. The pump control panel shall consist of a custom made multiple sections enclosure sized adequately to accommodate all motor starting equipment, control, instrumentation, and auxiliary devices required for the operation of the pump station equipment.

2.02 RATINGS

A. The pump control panel shall be 600 V class suitable for operation on three-phase or single-phase, 60 Hz system. The system operating voltage and number of wires shall be as indicated on the Drawings.

2.03 CONSTRUCTION

A. The pump control panel enclosure shall be a NEMA 3R or NEMA 3RX, with hinged outer and inner doors, constructed of 12 gauge steel minimum, fully welded construction. NEMA 3RX control panel enclosure shall be 12 gauge, 316 stainless steel. Minimum dimensions of enclosure shall be as indicated on the drawings. Inner door shall be hinged and provided with suitable latches to secured door in place. Outer door shall be provided with a 3-point latching mechanism and handle with provisions for padlocking. The enclosure base shall have a 2" flange all around, 11 gauge minimum, with pre-drilled holes for anchoring the control panel to the concrete floor. Enclosure shall have a powder coated light grey finished paint color. Provide paint chips samples to City for their approval.

B. The control panel enclosure shall include the following accessories:

1. Swing-Out inner door for mounting control and auxiliary devices behind the exterior door.
2. Backpanel for mounting control devices, terminal blocks, control power transformers and other auxiliary devices.
3. Enclosure door contact to send a remote alarm to SCADA RTU when any of the outside enclosure door is opened.
4. Low profile fluorescent light to illuminate interior of control panel enclosure. Light shall be turned on with a light switch to be mounted flush on the enclosure swing-out panel.
5. Thermostatically controlled heaters and ventilation fans.
6. Convenience Receptacle to be mounted flush on the enclosure swing-out panel. Receptacle shall be industrial grade, 120V, 20A, GFCI, grounded type.
7. Segregate AC, DC, and intrinsically safe circuits in different wiring troughs and terminate on physically separate terminal strips.
8. Identify all wiring at each termination point (both ends) using appropriate wrap-around labels as manufactured by Brady, Seaton, or approved equal.
9. All electrical wiring within the panels shall be color-coded, bundled, bound with plastic strip lock straps, installed in plastic ducts, and terminated on numbered terminal strips. All external connections shall be properly identified by function and number in accordance with ISA standards.
10. Provide identification and function nameplates at each item installed in the panel. The nameplates shall be black phenolic plastic with white letters and shall be fastened with drive pins or round head Type 304 stainless steel screws. No stick-on wire or tie-wrap anchors shall be used.

2.04 SURGE PROTECTION DEVICE

A. Surge protection device shall have 100,000 amp peak current rating for all mode of protection, 65 kAIC fault current fusing level, LED status and audible alarms. Surge protection device shall be as manufactured by SOLA Hevi-Duty, model number STV100K Series or approved equal.

2.05 POWER MONITORING RELAY

A. A power monitoring relay shall be provided to monitor all 3-phases of the power system. The power monitoring relay shall detect undervoltage, overvoltage, phase loss and phase reversal. Output contacts of this relay shall be provided as an input to the SCADA RTU and to the Pump Vision Controller. Power monitoring relay shall be “Symcom” Model 250A, or approved equal.

2.06 CIRCUIT BREAKERS

A. Circuit breaker shall be molded case type, rated as indicated on the Drawings.

2.07 PANELBOARD AND DRY-TYPE TRANSFORMER

A. Panelboards shall have ampacity and voltage ratings indicated on the Drawings. Panelboards used in 240 VAC maximum rated voltage systems shall have short-circuit ratings as shown on the Drawings, but not less than 10,000 A RMS symmetrical. Panelboards shall be custom constructed to utilize minimum enclosure space. Circuit breakers shall be bolted on type. Provide phenolic nameplates to identify panelboard and all branch circuit devices.

B. Dry-type transformer shall be Open Core and Coil, Industrial Control Transformer, 180 Deg. C insulation class and maximum temperature rise of 115 Deg. C. Dry type transformers primary and secondary voltage and kVA rating shall be as indicated on the Drawings. Dry type transformers shall be as manufactured by Acme Electric or Jefferson Electric.

2.08 MAGNETIC CONTACTORS

A. Magnetic contactors shall be sized for the horsepower or current rating of the pump motor. Contactors shall be compact size, and shall conform to IEC Standards, and be UL 508 listed.

B. Magnetic contactors shall be 3-pole switching and shall have straight-through wiring. Each contactor shall be provided with the number of auxiliary contacts required for the intended control function indicated on the Drawings, but shall be no less than two (2) NO and two (2) NC auxiliary contact.

C. Coil voltage shall be as indicated on the Drawings.

D. Where indicated on the Drawings, contactors shall be mechanically and electrically interlocked.

E. Magnetic contactors shall be Allen-Bradley Bulletin 100-C or approved equal.

F. Provide one spare contactor of each size used in this project.

2.09 SOLID STATE REDUCED VOLTAGE MOTOR CONTROLLERS (SSRV)

A. The controller shall be Allen-Bradley SMC Flex and shall include the following features:

1. Integrated bypass contactor that is closed once the motor is up to full speed
2. Electronic overload protection with adjustable trip class
3. Four programmable auxiliary contacts
4. Selectable control capabilities: soft start, kickstart, current limit start, dual ramp, full voltage, linear speed, preset slow speed, soft stop
5. Additional control capabilities: Pump Control
6. LCD display
7. Keypad programming for configuration
8. Built-in, selectable protective functions for: overload, jam, stall, excessive starts per hour, underload, over/under voltage, voltage unbalance
9. Metering capabilities for: current, voltage, kW, kWH, power factor, motor thermal capacity utilized, elapsed time
10. The SMC unit shall be provided with line side protective modules. The modules shall contain capacitors and metal oxide varistors (MOVs) that protect the internal power circuitry from severe electrical transients and/or high electrical noise.

B. Provide IEC rated isolating contactor at the line side of the SSRV.

C. Provide suitable sized current limiting fuse to protect SSRV from high level short circuit faults.

D. Provide door mounted 120V AC elapse time meter.

E. Provide one spare SSRV of each size used in this project.

2.10 CONTROL, INDICATION AND AUXILIARY DEVICES

A. Provide fused control power transformers, indicating lights, HOA selector switches, toggle switches, pushbuttons, intrinsically safe relays, zener barriers, interposing relays, and other control, indication and auxiliary devices indicated on the Drawings. Indicating lights shall be LED push-to-

test type, with lens colors as indicated on the drawings. Selector switches and pushbuttons shall be NEMA 4X, with contact block arrangement as required for the application.

B. The pump control panel manufacturer shall provide, install and wire the Over-Temperature and/or Seal Failure Detection Relays for the monitoring and protection of the existing pump motors. The Over-Temperature and/or seal Failure Detection Relay shall be installed in the motor starter compartment of each of the pumps motors. Provide Flygt MiniCAS relay or Gems Warrick Series Electromechanical Control as indicated on the Drawings.

C. Control relays shall be general purpose, blade type, 3PDT contact configuration with neon indicating light. Provide matching socket base with hold down clips.

D. Timing relay shall be DIN rail mounted, multi-function type (On Delay, Off Delay, One Shot, Flasher), with selectable timing range of 0.05 Sec to 10 hours, built-in status LED and surge protection. Output contact shall be SPST, rated at 1A at 300VAC. Timing Relay shall be Allen-Bradley Bulletin 700-FE or approved equal. Where more than one output is required, provide general purpose control relay as specified above.

E. Each section of the control panel shall be provided with anti-condensation space heaters, thermostatically controlled. Provide ventilation fans with thermostat controls as indicated on the Drawings.

F. Provide a programmable current trip relay with 4-20 mA current input and four (4) alarm trip isolated output contacts, individually programmed for different current levels, and rated 5A at 24VDC/250VAC. The programmable current trip relay shall include a 5 digit process and status readout. Programmable current trip relay shall be Moore Industries, Type SPA2 or approved equal with digital readout.

G. Submersible level transmitter shall be specifically designed for use in pump/lift stations applications. Level transmitter shall be intrinsically safe (IS) suitable for use in Class I, Division 1, Group D environment. Transmitter cable shall be molded polyurethane, vented with Kevlar, 4 conductors, and shall be provided with cable hanger. Level transmitter shall be as manufactured by Process Measurement & Controls, Inc. (PMC) VersaLine VL2000 Series, 4-20 mA electrical configuration, titanium housing, and cable length sufficient to reach the wet well from the control panel without splicing. Full scale range shall be selected to fit the depth of the wet well. Provide with a Moisture Protection Reference Volume device, PMC Catalog Number MP 11, for installation inside the Control Panel Section.

H. Conductivity type water level probes shall be Gems Warrick Series 3F, flanged mounted with die-cast aluminum terminal housing, epoxy coated. Electrode probes shall be GEMS Warrick type 3R, stainless steel. Number of electrode probes shall be as indicated on the Drawings. Provide a GEMS

Series 16 solid state control relay to interface with the conductivity probes and provide level control for the pumps.

I. Intrinsically safe relays shall be provided with SPDT contact to control loads to 2A at 250VAC or 1A at 24VDC. Supply voltages shall be as indicated on the Drawings. Intrinsically safe relays shall be PR Electronics type 5202B, or approved equal.

J. Repeaters barriers shall be provided to transmit signals in an intrinsically safe manner. Repeaters barriers shall be rated with supply voltages of 21.6 to 253 VAC and 19.2 to 300 VDC. Repeaters shall be designed for use in conjunction with level transmitter equipment operating in hazardous areas defined as Class I, Division 1, Group D. Repeater barrier shall be dual channel, PR Electronics type 5104B or approved equal.

K. Elapse time meter shall be round case 2-1/2" diameter, 120 VAC input voltage, non-reset, 6 digit counter hour register with tenths of hour register. Elapse time meter shall be weather resistant with sealed window and flange for panel mounting.

2.11 LEVEL CONTROLLER

A. Level controller shall be microprocessor based, with inputs and outputs for controlling and monitoring up to four pumps. Level controller shall be California Motor Controls Pump Vision PV600. Level controller shall be provided with one (1) RS485 port and one Ethernet RJ45. Level controller shall be installed on the control section of the control panel. The Pump Vision PV600 shall be fully programmed and provided as a package from California Motor Controls. A sunshield shall be provided to reduce glare while interfacing with the level controller. Sunshield shall be as manufactured by Smith & Loveless Inc., Shade Aid ® HMI Protector. No substitutions will be accepted.

2.12 ALTERNATING RELAY

A. Alternating relay shall be a Duplex Controller, with three level inputs for Sequence ON-Simultaneous OFF operation (S.O.S.O). Control Voltage shall be 120VAC. Alternating Relay shall be Macromatic Catalog No. ARP120A8R or approved equal.

2.13 120VAC UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. UPS system shall be UL 1778 listed for industrial applications without derating and for use in UL 508 applications. UPS capacity is to be calculated by Pump Control Panel manufacturer, but in no case should be less than 1500 VA.

B. UPS shall be provided with a relay card with output contacts to indicate UPS fault, Summary Alarm, Bypass Active, Battery Low, and AC Power Fail. The summary alarm contact is to be wired to the SCADA RTU.

C. UPS shall be Marathon Vault Series or approved equal.

2.14 24VDC POWER SUPPLY

A. The 24 VDC power supply shall be DIN rail mounted, auto select 115/230VAC input voltage, output rated at a nominal 5.0 A at 24 VDC, UL 508 listed. Power supply shall be SOLA Catalog Number SDN 5-24-100P or approved equal.

2.15 CONTROL REQUIREMENTS

A. The pump level controller shall be fully programmed by the control panel manufacturer to receive analog signal from the submersible level transmitter. Pump level controller shall perform the control functions described herein and as indicated on the Drawings. A listing of the controller programmed parameters shall be submitted for City's review and approval.

B. The pump controller shall continuously monitor the wet well water level. The level controller shall be programmed to alternate the lead/lag function to each of the pump station pumps. On rising water level the lead pump shall be started and run until the demand of the pump station is met. If the first pump (lead Pump) is not able to meet the inflow water demand, the second pump (lag Pump) shall be started at the designated water level. On falling water level, each pump shall be stopped once the water level in the wet well reach each pump lower stopped level. The pumps shall be alternated after each pump down cycle.

C. A second submersible level transmitter and programmable current trip relay shall be provided as a backup to the primary submersible level transmitter and pump level controller. The backup control system shall be operational upon reaching the high water level setpoint and shall immediately send a signal to start the first pump after a programmed time delay. Subsequent pumps will be started after a programmed time delay. The pumps will remain on the backup level control until the water level reaches the low water level setppoint, which upon activation, will stop all pumps. Both, the high-high water level alarm and the low water level alarm shall provide an input to the level controller.

D. Pump controls utilizing conductivity type level probes, shall sequence the pumps utilizing an alternating relay. The lead and lag pump are alternated after each pump down cycle. The alternating relay will be bypassed if the Hi level alarm probe is activated, in which case it will sequentially start the pumps, and will stop the pumps until the Low Level alarm probe is de-activated.

E. The backup control high-high water level alarm and the low level alarm shall send an alarm to the City SCADA RTU. The high-high level alarm output of the backup control shall, at the same time, provide an additional start signal to the pumps backup control in case the high level control was not able to start the pumps.

F. All alarms, indications, controls and instrumentation wiring interfacing with the City's SCADA RTU shall be terminated into terminal blocks for easy extension to the City's SCADA RTU equipment. Wiring from these terminal blocks to the City's SCADA RTU equipment shall also be provided under the supervision of Thunderbird Communication, the City's SCADA contractor.

2.16 NAMEPLATES

A. Provide phenolic nameplates to identify each component of the pump control panel. A nameplate shall also be installed on the outside enclosure door identifying the enclosure as the Storm Drain Pump Station Control Panel. Each nameplate shall be appropriately sized for the engraved legend. The lettering shall be black $^{3}/_{16}$-inch high, on a white background.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. All factory tests required by the latest ANSI, NEMA and UL standards shall be performed.

B. The pump controller control and alarm functions shall be tested by simulating actual field conditions. The operation of all pump starters shall be tested and verified to be in accordance with the control and alarm functions specified. A test plan shall be submitted to the City for approval prior to performing this factory test. Test plan shall include all proposed metering and protection settings for the Solid State Reduced Voltage Starter.

C. A certified test report of all standard production tests, including all control and alarm functions simulation test shall be provided with the pump control panel operations and maintenance manual.

D. Factory tests as outlined above may be witnessed by the City's representative.

1. The manufacturer shall notify the City two (2) weeks prior to the date the tests are to be performed.

2. The manufacturer shall include the cost of transportation and lodging for up to three (3) City's representatives. The cost of meals and incidental expenses shall be the City's responsibility.

3.02 EXAMINATION

A. Contractor shall fully inspect shipments for damage and report damage to manufacturer and file claim upon shipper, if necessary.

B. Overload protection must be properly sized and coordinated for each motor starter unit.

C. Contractor to verify CEC clearances as dictated on the Contract Drawings prior to installation. Verify UL labeling of the assembly prior to installation.

3.03 INSTALLATION

A. Contractor to follow the installation instructions supplied by the manufacturer.

B. Control wiring shall be as shown on the Contract Drawings except as modified by the approval and submittal process. Interface all local and remote devices into the control wiring and operational systems for each load.

3.04 FIELD ADJUSTMENTS

A. Follow the manufacturer's instructions and the contract documents concerning any relay setting, timing relays, or startup of components.

3.05 FIELD TESTING

A. Test the completed installation to demonstrate to the City that the system is performing is intended control function in accordance with this specification, contract drawings and manufacturer's shop drawings.

B. Test each individual SCADA RTU input for proper transmission and confirmation that signal has been received at the City's SCADA System Central Monitoring Station. This test shall be conducted in coordination with the City's SCADA Consultant.

C. Generate a field report on tests performed, test values experienced, etc., and make available to the City upon request.

3.06 FIELD QUALITY CONTROL

A. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in the startup of the equipment specified under this section for a period of 2 working days per site. The manufacturer's representative shall provide technical direction and assistance to the Contractor in connections and adjustments, and testing of the assembly, components contained therein, and provided field devices.

B. The following minimum work shall be performed by the manufacturer's representative, with the assistance of the Contractor:

1. Verify all power wiring and control wiring and verify basic operation of each starter from control power source.
2. Calibrate any solid-state metering or control relays for their intended purpose and make written notations of adjustments on record drawings.
3. Set the overload protection and metering parameters. Provide a listing of all settings.

4. Set and calibrate all analog transmitters interfacing with the pump level control equipment. Adjust all level control setpoints and test the entire pump station controls to the satisfaction of the City.
5. Verify installation level and operation of the conductivity type level probes. Cut level probes to lengths matching existing level probes.
6. Verify installation level and operation of the backup level transmitter and programmable current trip. Program current trip relay with settings provided by the City. Verify start and stop operation of pumps and alarm/indications to level controller and to SCADA RTU.
7. Simulate each SCADA RTU input by actual operation of the field device or control panel device or, if this is not practical, by a jumper across the device terminals. Verify that the correct SCADA RTU input is actuated, transmitted and received at the City's SCADA System Central Monitoring Station.

C. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.07 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations. Equipment shall be inspected prior to the generation of any reports.

B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

3.08 TRAINING

A. The Contractor shall provide a training session for up to five (5) City's representatives for 1 workday at the jobsite or other office location chosen by the City.

B. The training session shall be conducted by a manufacturer's qualified representative.

C. The training program shall consist of the following:

1. Review of the factory record shop drawings.
2. Review of all control schematics and pump controller control logic.
3. Review contactor coil replacement and contact replacement procedures.
4. Review maintenance procedures for Solid State Reduced Voltage Starters.
5. Discuss the maintenance timetable and procedures to be followed in an ongoing maintenance program.

6. Provide three-ring binders to participants complete with copies of drawings and other course material covered.

END OF SECTION

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