EAST WATER RECLAMATION FACILITY SCREW PUMP

22-0028-UT

CONTRACT DOCUMENTS & SPECIFICATIONS

Prepared for

CLEARWATER
BRIGHT AND BEAUTIFUL · BAY TO BEACH

CONTRACT DOCUMENTS

MARCH 2023

City of Clearwater, Florida
East Water Reclamation Facility Screw Pump
22-0028-UT

TABLE OF CONTENTS

SECTION I	ADVERTISEMENT OF BIDS & NOTICE TO CONTRACTORS
SECTION II	INSTRUCTIONS TO BIDDERS
SECTION III	GENERAL CONDITIONS
SECTION IV	TECHNICAL SPECIFICATIONS
SECTION IVa	SUPPLEMENTAL TECHNICAL SPECIFICATIONS
SECTION V	CONTRACT DOCUMENTS

Prepared in the Office of the City Engineer

SECTION 1

INVITATION TO BID
NOTICE TO CONTRACTORS

East Water Reclamation Facility Screw Pump

Documents and plans for Project #22-0028-UT

are available at www.myclearwater.com/bid.

The work includes: Replace existing screw pumps, grease pumps and motors; refurbish the existing slide gates; modify the existing electrical system.

Pre-Bid Conference:
April 05, 2024 at 10:00am
Zoom Meeting:
Meeting ID: 841 5574 1994
Passcode: 929049
Pre-qualification DEADLINE: April 24, 2024
Category: Water Treatment Facilities
Pre-qualification Amount: $ 2 Million
Bids DUE: May 8, 2024 at 2:00pm
City of Clearwater, Project # 22-0028-UT
Procurement Office, 3rd Floor
100 S. Myrtle Ave, Clearwater, FL 33756-5520

Bid Opening: May 8, 2024 at 2:00pm
Zoom Meeting:
Meeting ID: 899 3116 3322
Passcode: 713148

Issued by Lori Vogel, CPPB, Procurement Manager

For additional information contact Engineering Dept.: 727-562-4750

SECTION II

INSTRUCTIONS TO BIDDERS

Table of Contents

1. COPIES OF BIDDING DOCUMENTS 1
2. QUALIFICATION OF BIDDERS 1
3. EXAMINATION OF CONTRACT DOCUMENTS AND SITE 1
4. INTERPRETATIONS AND ADDENDA 2
5. BID SECURITY OR BID BOND 3
6. CONTRACT TIME 3
7. LIQUIDATED DAMAGES 3
8. SUBSTITUTE MATERIAL AND EQUIPMENT 3
9. SUBCONTRACTORS 3
10. BID/PROPOSAL FORM 4
11. SUBMISSION OF BIDS 4
12. MODIFICATION AND WITHDRAWAL OF BIDS 5
13. REJECTION OF BIDS 5
14. DISQUALIFICATION OF BIDDER 5
15. OPENING OF BIDS 5
16. LICENSES, PERMITS, ROYALTY FEES AND TAXES 5
17. IDENTICAL TIE BIDS/VENDOR DRUG FREE WORKPLACE 6
18. AWARD OF CONTRACT 7
19. BID PROTEST 7
20. TRENCH SAFETY ACT 8
21. CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL MANAGEMENT MEASURES 8

1. COPIES OF BIDDING DOCUMENTS

1.1. Complete sets of the Bidding Documents are accessible through the City of Clearwater website at address: www.myclearwater.com/bid. Bidding Documents may include, but are not limited to, plans, specifications, bond forms, contract form, affidavits, bid/proposal form, and addendums.

1.2. Complete sets of Bidding Documents must be used in preparing bids. Neither the City nor the Engineer shall be liable for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents, by Bidders, sub-bidders, or others.

2. QUALIFICATION OF BIDDERS

2.1. Each prospective Bidder must pre-qualify to demonstrate, to the complete satisfaction of the City of Clearwater, that the Bidder has the necessary facilities, equipment, ability, financial resources and experience to perform the work in a satisfactory manner. An application package for pre-qualification may be obtained by contacting the City of Clearwater, Engineering Department, P.O. Box 4748, Clearwater, Florida 33758-4748 (mailing address); 100 South Myrtle Avenue, Clearwater, Florida 33756-5520 (street address) or by phone at (727) 562-4750. Pre-qualification requirement information is also available on the City of Clearwater Website at address:

www.myclearwater.com/government/city-departments/engineering/construction-management.

Contractors wanting to pre-qualify to bid on a project as a General Contractor must do so two weeks (ten workdays) prior to the bid opening date. Bidders currently pre-qualified by the City do not have to make reapplication. It is the Contractor's responsibility to confirm pre-qualification status before a Bid Opening.

The Contractor shall provide copies of the current Contractor License/Registration with the State of Florida and Pinellas County in the bid response.

3. EXAMINATION OF CONTRACT DOCUMENTS AND SITE

3.1. It is the responsibility of each Bidder, before submitting a Bid, to (a) examine the Contract Documents thoroughly; (b) visit the site to become familiar with local conditions that may in any manner affect cost, progress, performance or furnishing of the work; (c) consider and abide by all applicable federal, state and local laws, ordinances, rules and regulations; and (d) study and carefully correlate Bidder's observations with the Contract Documents, and notify Engineer in writing of all conflicts, errors or discrepancies in the Contract Documents.

3.2. For the purposes of bidding or construction, bidder may rely upon the accuracy of the technical data contained in reports of explorations and tests of subsurface conditions at the site which have been utilized by the Engineer in the preparation of the Contract Documents, but not upon non-technical data, interpretations or opinions contained therein or for the completeness thereof. Drawings relating to physical conditions of existing surface and subsurface conditions (except Underground Facilities) which are at or contiguous to the site and which have been utilized by the Engineer in preparation of the Contract Documents, may be relied upon by Bidder for accuracy of the technical data contained in such drawings but not upon the completeness thereof for the purposes of bidding or construction.

3.3. Information and data reflected in the Contract Documents with respect to Underground Facilities at or contiguous to the site are based upon information and data furnished to the City and Engineer by owners of such Underground Facilities or others, and the City does not assume responsibility for the accuracy or completeness thereof unless expressly provided in the Contract Documents.

3.4. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, Underground Facilities, other physical conditions, possible conditions, and possible changes in the Contract Documents due to differing conditions appear in the General Conditions.

3.5. Before submitting a Bid, each Bidder shall, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing the work in accordance with the time, price and other terms and conditions of the Contract Documents.

3.6. On request in advance, City will provide each Bidder access to the site to conduct such explorations and tests at Bidder's own expense as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the site to its former condition upon completion of such explorations and tests.

3.7. The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by the Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by the Contractor. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by the City unless otherwise provided in the Contract Documents.

3.8. The submission of a Bid will constitute an unequivocal representation by the Bidder that the Bidder has complied with every requirement of these Instructions to Bidders and that, without exception, the Bid is premised upon performing and furnishing the Work required by the Contract Documents by such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions of performance and furnishing of the work.

4. INTERPRETATIONS AND ADDENDA

4.1. All questions as to the meaning or intent of the Contract Documents are to be directed in writing to the Engineer. Interpretations or clarifications considered necessary by the Engineer in response to such questions will be issued by Addenda, via the Jiffy Reprographics Plan Room to all parties recorded by the Plan Room as plan holders having received the Bidding Documents. Questions received after the time frame specified on the pre-bid meeting agenda, prior to the date for opening of Bids, may not be answered. Only information provided by formal written Addenda will be binding. Oral and other interpretations of clarifications will be without legal effect.

4.2. Addenda may also be issued to modify the Bidding Documents as deemed advisable by the City or Engineer.

5. BID SECURITY OR BID BOND

5.1. Each Bid must be accompanied by Bid Security made payable to the City of Clearwater in an amount equal to ten percent (10%) of the Bidder's maximum Bid price and in the form of a certified or cashier's check or a Proposal/Bid Bond (on form provided in Section V) issued by a surety meeting the requirements of the General Conditions.

5.2. The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the required Payment and Performance bonds, whereupon the Bid Security will be returned. If the Successful Bidder fails to execute, deliver the Agreement and furnish the required Bonds within ten (10) days after the award of contract by the City Council, the City may annul the bid and the Bid Security of the Bidder will be forfeited. The Bid Security of any Bidder whom the City believes to have a reasonable chance of receiving the award may be retained by the City until the successful execution of the agreement with the successful Bidder or for a period up to ninety (90) days following bid opening. Security of other Bidders will be returned approximately fourteen (14) days after the Bid Opening.

5.3. The Bid Bond shall be issued in the favor of the City of Clearwater by a surety company qualified to do business in, and having a registered agent in, the State of Florida.

6. CONTRACT TIME

6.1. The number of consecutive calendar days within which the work is to be completed is set forth in the Technical Specifications.

7. LIQUIDATED DAMAGES

7.1. Provisions for liquidated damages are set forth in the Contract Agreement, Section V.

8. SUBSTITUTE MATERIAL AND EQUIPMENT

8.1. The contract, if awarded, will be on the basis of material and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or equal" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or equal" item may be furnished or used, application for its acceptance will not be considered by the Engineer until after the effective date of the Contract Agreement. The procedure for submittal of any such application is described in the General Conditions and as supplemented in the Technical Specifications.

9. SUBCONTRACTORS

9.1. If requested by the City or Engineer, the Successful Bidder, and any other Bidder so requested, shall, within seven (7) days after the date of the request, submit to the Engineer an experience statement with pertinent information as to similar projects and other evidence of qualification for each Subcontractor, supplier, person and organization to be used by the Contractor in the completion of the Work. The amount of subcontract work shall not exceed fifty percent (50%) of the Work except as may be specifically approved by the Engineer. If the Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, supplier, other person or organization, he may, before recommending award of the Contract to the City Council, request the Successful Bidder to submit an acceptable substitute without an increase in Contract Price or Contract Time. If the Successful Bidder declines to make any such substitution, the City may award the contract to the next lowest and most responsive Bidder

that proposes to use acceptable Subcontractors, Suppliers, and other persons and organizations. Declining to make requested substitutions will not constitute grounds for sacrificing the Bid Security to the City of any Bidder. Any Subcontractor, supplier, other person or organization listed by the Contractor and to whom the Engineer does not make written objection prior to the recommendation of award to the City Council will be deemed acceptable to the City subject to revocation of such acceptance after the Effective Date of the Contract Agreement as provided in the General Conditions.

9.2. No Contractor shall be required to employ any Subcontractor, supplier, person, or organization against whom he has reasonable objection.

10. BID/PROPOSAL FORM

10.1. The Bid/Proposal Form is included with the Contract Documents and shall be printed in ink or typewritten. All blanks on the Bid/Proposal Forms must be completed. Unit Prices shall be to no more than two decimal points in dollars and cents. The Bidder must state in the Bid/Proposal Form in words and numerals without delineation's, alterations or erasures, the price for which they will perform the work as required by the Contract Documents. Bidders are required to bid on all items in the Bid/Proposal form. The lump sum for each section or item shall be for furnishing all equipment, materials, and labor for completing the section or item as per the plans and contract specifications. Should it be found that quantities or amounts shown on the plans or in the proposal, for any part of the work, are exceeded or should they be found to be less after the actual construction of the work, the amount bid for each section or item will be increased or decreased in direct proportion to the unit prices bid for the listed individual items.

10.2. Bids by corporations shall be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal shall be affixed. The corporate address and state of incorporation shall be shown below the Signature. If requested, the person signing a Bid for a corporation or partnership shall produce evidence satisfactory to the City of the person's authority to bind the corporation or partnership.

10.3. Bids by partnerships shall be executed in the partnership name and signed by a general partner, whose title shall appear under the signature and the official address of the partnership shall be shown below the signature.

10.4. All names shall be typed or printed below the signature.

11. SUBMISSION OF BIDS

11.1. Sealed Bids shall be submitted at or before the time and at the place indicated in the Advertisement for Bids and shall be submitted in a sealed envelope with the project name and number on the bottom left hand corner. If forwarded by mail, the Bid shall be enclosed in another envelope with the notation "Bid Enclosed" on the face thereof and addressed to the City of Clearwater, attention Purchasing Manager. Bids will be received at the office indicated in the Advertisement until the time and date specified. Bids in any other form will not be accepted.

11.2. The sealed bid envelope shall contain, but not be limited to, the Proposal/Bid Bond and corresponding Power of Attorney, Affidavit, Non-Collusion Affidavit, Proposal (pages one

and two), Addendum Sheet, Bidder's Proposal, ~~and~~ Scrutinized Companies and Business Operations with Cuba and Syria Certification Form, and E-Verify form.

12. MODIFICATION AND WITHDRAWAL OF BIDS

12.1. Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered as described in the Advertisement of Bids. A request for withdrawal or a modification shall be in writing and signed by a person duly authorized to do so. Withdrawal of a Bid will not prejudice the rights of a Bidder to submit a new Bid prior to the Bid Date and Time. After expiration of the period for receiving Bids, no Bid may be withdrawn or modified.

12.2. After a bid is received by the City, the bidder may request to modify the bid for typographical or scrivener's errors only. The bidder must state in writing to the City that a typographical or scrivener's error has been made by the bidder, the nature of the error, the requested correction of the error, and what the adjusted bid amount will be if the correction is accepted by the City. The City reserves the right at its sole discretion to accept, reject, or modify any bid.

13. REJECTION OF BIDS

13.1. To the extent permitted by applicable State and Federal laws and regulations, the City reserves the right to reject any, and all Bids, and to waive any, and all informalities. Grounds for the rejection of a bid include but are not limited to a material omission, unauthorized alteration of form, unauthorized alternate bids, incomplete or unbalanced unit prices, or irregularities of any kind. Also, the City reserves the right to reject any Bid if the City believes that it would not be in the best interest of the public to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by the City. The City reserves the right to decide which bid is deemed to be the lowest and best in the interest of the public.

14. DISQUALIFICATION OF BIDDER

14.1. Any or all bids will be rejected if there is any reason for believing that collusion exists among the bidders, the participants in such collusion will not be considered in future proposals for the same work. Each bidder shall execute the Non-Collusion Affidavit contained in the Contract Documents.

15. OPENING OF BIDS

15.1. Bids will be opened and read publicly at the location and time stated in the Advertisement for Bids. Bidders are invited to be present at the opening of bids.

16. LICENSES, PERMITS, ROYALTY FEES AND TAXES

16.1. The Contractor shall secure all licenses and permits (and shall pay all permit fees) except as specifically stated otherwise in the Technical Specifications. The Contractor shall comply with all Federal and State Laws, County and Municipal Ordinances and regulations, which in any manner effect the prosecution of the work. City of Clearwater building permit fees and impact fees will be waived except as specifically stated otherwise in the Technical Specifications.

16.2. The Contractor shall assume all liability for the payment of royalty fees due to the use of any construction or operation process, which is protected by patent rights except as specifically stated otherwise in the Technical Specifications. The amount of royalty fee, if any, shall be stated by the Contractor.

16.3. The Contractor shall pay all applicable sales, consumer, use, and other taxes required by law. The Contractor is responsible for reviewing the pertinent State Statutes involving the sales tax and sales tax exemptions and complying with all requirements.

16.4. The City of Clearwater is exempt from state sales tax on materials purchased by the City and incorporated into the WORK. The City of Clearwater reserves the right to implement the Owner Direct Purchase (ODP) Option, as may be indicated in the Scope of Work Description in Section IV – Technical Specifications and as defined in Section III – General Conditions.

17. IDENTICAL TIE BIDS/VENDOR DRUG FREE WORKPLACE

17.1. In accordance with the requirements of Section 287.087 Florida Statutes regarding a Vendor Drug Free Workplace, in the event of identical tie bids, preference shall be given to bidders with drug-free workplace programs. Whenever two or more bids which are equal with respect to price, quality, and service are received by the City for the procurement of commodities or contractual services, a bid received from a business that certifies that it has implemented a drug-free workplace program shall be given preference in the award process. Established procedures for processing tie bids will be followed if none or all of the tied bidders have a drug-free workplace program. In order to have a drug-free workplace program, a contractor shall supply the City with a certificate containing the following six statements and the accompanying certification statement:

(1) Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.

(2) Inform employees as to the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation, and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.

(3) Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified in subsection (1).

(4) In the statement specified in subsection (1), notify the employees that, as a condition of working on the commodities or contractual services that are under bid, the employee will abide by the terms of the statement and will notify the employer of any conviction of, or plea of guilty or nolo contendere to, any violation of chapter 893, or of any controlled substance law, of the United States, or of any state, for a violation occurring in the workplace no later than five (5) days after such conviction.

(5) Impose a sanction on or require the satisfactory participation in a drug abuse assistance or rehabilitation program if such is available in the employee's community, by any employee who is so convicted.

(6) Make a good faith effort to continue to maintain a drug-free workplace through implementation of this section.

I certify that this firm does/does not (select only one) fully comply with the above requirements.

18. AWARD OF CONTRACT

18.1. Discrepancies between words and figures will be resolved in favor of words. Discrepancies in the multiplication of units of work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

18.2. In evaluating the Bids, the City will consider the qualifications of the Bidders, whether the Bids comply or not with the prescribed requirements, unit prices, and other data as may be requested in the Bid/Proposal form. The City may consider the qualifications and experience of Subcontractors, suppliers and other persons and organizations proposed by the Contractor for the Work. The City may conduct such investigations as the City deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers and other persons, and organizations to perform and furnish the Work in accordance with the Contract Documents to the City's satisfaction within the prescribed time.

18.3. If the Contract is to be awarded, it will be awarded to the lowest responsible, responsive Bidder whose evaluation by the City indicates to the City that the award will be in the best interest of the City.

18.4. Award of contract will be made for that combination of base bid and alternate bid items in the best interest of the City, however, unless otherwise specified all work awarded will be awarded to only one Contractor.

18.5. The successful bidder/contractor will be required to comply with Section 119.0701, Florida Statutes, specifically to:

(a) Keep and maintain public records that ordinarily and necessarily would be required by the City of Clearwater in order to perform the service;

(b) Provide the public with access to public records on the same terms and conditions that the City of Clearwater would provide the records and at a cost that does not exceed the cost provided in this chapter or as otherwise provided by law;

(c) Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law; and

(d) Meet all requirements for retaining public records and transfer, at no cost, to the City of Clearwater all public records in possession of the contractor upon termination of the contract and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to the public agency in a format that is compatible with the information technology systems of the City of Clearwater.

19. BID PROTEST

19.1. RIGHT TO PROTEST:

Pursuant to Section 2.562(3), Clearwater Code of Ordinances, a bidder who submitted a response to a competitive solicitation and was not selected may appeal the decision through the bid protest procedures, a copy of which shall be available in the Procurement Division. A protesting bidder must include a fee of one percent of the amount of the bid or proposed contract to offset the City’s additional expenses related to the protest. This fee shall not exceed

$5,000.00 nor be less than $50.00. Full refund will be provided should the protest be upheld. No partial refunds will be made.

20. TRENCH SAFETY ACT

20.1. The Bidder shall comply with the provisions of the City of Clearwater's Ordinance related to trench digging (Ordinance No. 7918-08) along with the Florida Trench Safety Act (Sections 553.60-553.64, Florida Statutes) and the provisions of the Occupational Safety and Health Administration's (OSHA) excavation safety standards, 29 C.F.R.s 1926.650 Subparagraph P, or current revisions of these laws.

21. CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL MANAGEMENT MEASURES

21.1. The Bidder shall comply with the provisions of the Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) stormwater permit and implement stormwater pollution prevention plans (SWPPP's) or stormwater management programs (both using best management practices (BMPs) that effectively reduce or prevent the discharge of pollutants into receiving waters.

A. The control of construction-related sediment loadings is critical to maintaining water quality. The implementation of proper erosion and sediment control practices during the construction stage can significantly reduce sediment loadings to surface waters.

B. Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.

NPDES Management Measures available at City of Clearwater Engineering Environmental Division and EPA websites to help address construction-related Best Management Practices.

SECTION III

GENERAL CONDITIONS

Table of Contents:

1. DEFINITIONS 1
2. PRELIMINARY MATTERS 5
2.1. DELIVERY OF BONDS AND CERTIFICATES OF INSURANCE 5
2.2. COPIES OF DOCUMENTS 5
2.3. COMMENCEMENT OF CONTRACT TIME/NOTICE TO PROCEED, STARTING THE PROJECT 5
2.4. BEFORE STARTING CONSTRUCTION 5
2.5. PRECONSTRUCTION CONFERENCE 6
2.6. PROGRESS MEETINGS 6
3. CONTRACT DOCUMENTS, INTENT 6
3.1. INTENT 6
3.2. REPORTING AND RESOLVING DISCREPANCIES 7
4. AVAILABILITY OF LANDS, SUBSURFACE AND PHYSICAL CONDITIONS, REFERENCE POINTS 7
4.1. AVAILABILITY OF LANDS 7
4.2. INVESTIGATIONS AND REPORTS 7
4.3. PHYSICAL CONDITIONS, UNDERGROUND FACILITIES 8
4.4. REFERENCE POINTS 8
5. BONDS AND INSURANCE 9
5.1. PERFORMANCE AND PAYMENT BOND/CONTRACT BOND 9
5.2. INSURANCE REQUIREMENTS 9
5.2.1. COMMERCIAL GENERAL LIABILITY INSURANCE 9
5.2.2. COMMERCIAL AUTOMOBILE LIABILITY INSURANCE 10
5.2.3. WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE 10
5.2.4. PROFESSIONAL LIABILITY/MALPRACTICE/ERRORS OR OMISSIONS INSURANCE 10
5.2.5. CONTRACTOR'S EQUIPMENT/INLAND MARINE/PROPERTY INSURANCE 10
5.2.6. BUILDER'S RISK INSURANCE 10
5.3. OTHER INSURANCE PROVISIONS 10
5.4. WAIVER OF RIGHTS 11
6. CONTRACTOR'S RESPONSIBILITIES 12
6.1. SUPERVISION AND SUPERINTENDENCE 12
6.2. LABOR, MATERIALS AND EQUIPMENT 12
6.3. SUBSTITUTES AND "OR EQUAL" ITEMS 13
6.4. SUBCONTRACTORS, SUPPLIERS AND OTHERS 13
6.5. USE OF PREMISES 14
6.5.1. STAGING AREAS 15
6.5.2. RESTORATION TIME LIMITS 15
6.6. LICENSE AND PATENT FEES, ROYALTIES AND TAXES 15
6.7. LAWS AND REGULATIONS 16
6.7.1. E-VERIFY 16
6.8. PERMITS 16

6.9. SAFETY AND PROTECTION 17
6.10. EMERGENCIES 18
6.11. DRAWINGS 18
6.11.1. SHOP DRAWINGS, SAMPLES, RFIs, AND SUBMITTAL REVIEW 18
6.11.2. AS-BUILT DRAWINGS 19
6.11.3. CAD STANDARDS 21
6.11.4. DELIVERABLES 23
6.12. CONTRACTOR'S GENERAL WARRANTY AND GUARANTEE 23
6.13. CONTINUING THE WORK 23
6.14. INDEMNIFICATION 24
6.15. CHANGES IN COMPANY CONTACT INFORMATION 24
6.16. PUBLIC RECORDS 24
7. OTHER WORK 25
7.1. RELATED WORK AT SITE 25
7.2. COORDINATION 26
8. OWNER'S RESPONSIBILITY 26
9. OWNER REPRESENTATIVE'S STATUS DURING CONSTRUCTION 26
9.1. OWNER'S REPRESENTATIVE 26
9.2. CLARIFICATIONS AND INTERPRETATIONS 27
9.3. REJECTING OF DEFECTIVE WORK 27
9.4. SHOP DRAWINGS, CHANGE ORDERS, AND PAYMENTS 27
9.5. DECISIONS ON DISPUTES 27
9.6. LIMITATIONS ON OWNER REPRESENTATIVE'S RESPONSIBILITIES 28
10. CHANGES IN THE WORK 29
11. CHANGES IN THE CONTRACT PRICE 29
11.1. CHANGES IN THE CONTRACT PRICE 29
11.2. ALLOWANCES AND FINAL CONTRACT PRICE ADJUSTMENT 31
11.3. UNIT PRICE WORK 31
12. CHANGES IN THE CONTRACT TIME 31
13. TESTS AND INSPECTIONS, CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK 32
13.1. TESTS AND INSPECTION 32
13.2. UNCOVERING THE WORK 33
13.3. OWNER'S REPRESENTATIVE MAY STOP THE WORK 33
13.4. CORRECTION OR REMOVAL OF DEFECTIVE WORK 33
13.5. WARRANTY/CORRECTION PERIOD 34
13.6. ACCEPTANCE OF DEFECTIVE WORK 34
13.7. OWNER MAY CORRECT DEFECTIVE WORK 34
14. PAYMENTS TO CONTRACTOR AND COMPLETION 35
14.1. APPLICATION FOR PROGRESS PAYMENT 35
14.2. CONTRACTOR'S WARRANTY OF TITLE 36
14.3. REVIEW OF APPLICATIONS FOR PROGRESS PAYMENTS 36
14.4. PARTIAL UTILIZATION 37
14.5. FINAL INSPECTION 37
14.6. FINAL APPLICATION FOR PAYMENT 37
14.7. FINAL PAYMENT AND ACCEPTANCE 38
14.8. WAIVER OF CLAIMS 38

15. SUSPENSION OF WORK AND TERMINATION 39
15.1. OWNER MAY SUSPEND THE WORK.....39
15.2. OWNER MAY TERMINATE 39
15.3. CONTRACTOR MAY STOP WORK OR TERMINATE 40
16. DISPUTE RESOLUTION.....40
17. MISCELLANEOUS.....41
17.1. SUBMITTAL AND DOCUMENT FORMS.....41
17.2. GIVING NOTICE.....41
17.3. NOTICE OF CLAIM.....41
17.4. PROFESSIONAL FEES AND COURT COSTS INCLUDED.....41
17.5. ASSIGNMENT OF CONTRACT 41
17.6. RENEWAL OPTION 41
17.7. ROLL-OFF CONTAINERS AND/OR DUMPSTERS 42
18. ORDER AND LOCATION OF THE WORK.....42
19. MATERIAL USED 42
20. CONFLICT BETWEEN PLANS AND SPECIFICATIONS 42
21. OWNER DIRECT PURCHASE (ODP) 42
21.1. SALES TAX SAVINGS.....42
21.2. TITLE AND OWNER RISK.....43
21.3. CONTRACTOR'S RECEIPT OF MATERIALS.....43
21.4. ODP RECORDS, WARRANTIES, AND INDEMNIFICATION 44
22. RESIDENT NOTIFICATION OF START OF CONSTRUCTION.....44
22.1. GENERAL.....44
22.2. EXAMPLE.....45
23. PROJECT INFORMATION SIGNS 45
23.1. SCOPE AND PURPOSE.....45
23.2. PROJECT SIGN, FIXED OR PORTABLE 46
23.3. FIXED SIGN 46
23.4. PORTABLE SIGNS 46
23.5. SIGN COLORING.....46
23.6. SIGN PLACEMENT 46
23.7. SIGN MAINTENANCE.....46
23.8. TYPICAL PROJECT SIGN 47
24. AWARD OF CONTRACT, WORK SCHEDULE AND GUARANTEE .47
25. SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH CUBA AND SYRIA CERTIFICATION FORM AND ISRAEL CERTIFICATION FORM.....48

1. DEFINITIONS

Addenda

Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the contract documents.

Agent

Architect, engineer or other outside agency, consultant or person acting on behalf of the City.

Agreement

The written contract between Owner and Contractor covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

Application for Payment

The form accepted by Engineer which is to be used by Contractor in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

Approve

The word approve is defined to mean satisfactory review of the material, equipment, or methods for general compliance with the design concepts and with the information given in the Contract Documents. It does not imply a responsibility on the part of the Engineer to verify in every detail conformance with the Drawings and Specifications.

Bid

The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the work to be performed.

Bidding Documents

The advertisement or invitation to Bid, instructions to bidders, the Bid form, and the proposed Contact Documents (including all Addenda issued prior to receipt of Bids).

Bonds

Performance and payment bonds and other instruments of security.

Change Order

A written order to Contractor signed by Owner and Contractor authorizing an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time issued on or after the effective date of the Agreement.

City

The City of Clearwater, Pinellas County, Florida.

Construction Inspector

A person who is the authorized representative of the Construction Manager and inspects City construction projects in order to ensure the Contractor's work complies with the intent of the Contract Documents.

Construction Manager

The person who is typically in responsible charge of City construction projects. The Construction Manager assumes responsibility for the management of construction contracts at the Preconstruction Conference. The Construction Manager chairs the Preconstruction Conference and is the authority on any disputes or decisions regarding

contract administration and performance. The Construction Manager typically acts as the Owner's Representative during construction.

Contract Documents

The Agreement, Addenda (which pertain to the Contract Documents), Contractor's Bid (including documentation accompanying the bid and any post-Bid documentation submitted prior to the execution of the Agreement) when attached as an exhibit to the Agreement, the Bonds, Instructions to Bidders, these General Conditions, any Supplementary Conditions, the Specifications and the Drawings, any other exhibits identified in the Agreement, together with all Modifications issued after the execution of the Agreement.

Contract Price

The Contract price constitutes the total compensation (subject to authorized adjustments) payable by Owner to Contractor for performing the Work.

Contract Time

The number of days or the date stated in the Agreement for the completion of the Work.

Contractor

The Person with whom the Owner has entered into the Agreement. For the purposes of this contract, the person, firm, or corporation with whom this contract or agreement has been made by the City of Clearwater or its duly authorized representative.

Critical Path Method Construction Schedule (CPM)

A graphic format construction schedule that displays construction activities as they relate to one another for the purpose of identifying the most efficient way to perform the work in a timely manner. The critical path identifies which activity is critical to the execution of the schedule.

Day

A calendar day of twenty-four (24) hours measured from midnight to the next midnight.

Defective

An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to Engineers recommendation of final payment.

Drawings

The drawings, which will be identified in Technical Specifications or the Agreement, which show the character and scope of the Work to be performed and which have been prepared or approved by Engineer and are referred to in the contract documents. Shop drawings are not Drawings as so defined.

Engineer

The duly appointed representative of the City Manager of the City of Clearwater. For the purposes of this contract, the City Engineer of the City of Clearwater, Pinellas County, Florida, or his authorized representative. For certain projects, the Engineer may serve as the Owner's Representative during construction.

Engineer's Consultant

A Person having a contract with Engineer to furnish services as Engineer's independent

professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

F.D.O.T. Specifications

The Standard Specifications for Road and Bridge Construction as issued by the Florida Department of Transportation (latest English edition).

Furnish

The words "furnish", "furnish and install", "install", and "provide" or words of similar meaning shall be interpreted, unless otherwise specifically stated, to mean "furnish and install complete in place and ready for service".

Inspection

The term "inspection" and the act of inspecting means examination of construction to ensure that it conforms to the design concept expressed in the Drawings and Specifications. These terms shall not be construed to mean supervision, superintending, or overseeing.

Laws and Regulations

Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any kind of governmental bodies, agencies, authorities, and courts having jurisdiction.

Liens

Liens, charges, security interests or encumbrances upon real property or personal property.

Milestone

A principal event specified in the contract Documents relating to an intermediate completion date or time prior to the final completion date.

Notice to Proceed (NTP)

A written notice given by the Owner to the Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform his obligations under the Contract Documents.

Owner

The City of Clearwater, Florida. For the purposes of this contract, the person who is the City's authorized representative from the City's Department with whom will be responsible for the maintenance and operation of the Work once the Work is completed. For certain projects, a designee of the Owner may serve as the Owner's Representative during construction.

Owner's Representative

Designee of the Owner with authority to act on behalf of the Owner during construction.

Person

A natural person, or a corporation, partnership, firm, organization, or other artificial entity.

Project

The total construction of which the Work to be provided under the Contract Documents may be the whole or a part as indicated elsewhere in the Contract Documents.

Partial Utilization

Use by Owner of a substantially completed part of the Work for the purpose for which is intended (or a related purpose) prior to Final Completion of all the Work.

Representative of Contractor

The Contractor shall assign a responsible person or persons, one of whom shall be at the construction site at all times, that work is progressing. The names and positions of these persons shall be submitted to the City Engineer at the time of the pre-construction conference. This person or persons shall not be changed without written approval of City Engineer.

Request for Information (RFI)

An official written request for clarification of the intent of the contract documents from the Contractor to the Engineer.

Shop Drawing

All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a supplier and submitted by Contractor to illustrate material or equipment for some portion of the Work.

Specifications

Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

Subcontractor

A person having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the site.

Substantial Completion

The Work (or a specified part thereof) which has progressed to the point where, in the opinion of Engineer, as evidenced by Engineer's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work is complete and ready for final payment as evidenced by the Engineer's recommendation of final payment. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

Supplementary Conditions

The part of the Contract which amends or supplements these General Conditions.

Supplier

A manufacturer, fabricator, supplier, distributor, material man or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by the Contractor.

Surety

Any person, firm or corporation which is bound with Contractor and which engages to be responsible for Contractor and his acceptable performance of the Work by a Bid, Performance or Payment Bond.

Underground Facilities

All pipelines, conduits, ducts, cables, wires manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity,

gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal or treatment, traffic or other control systems or water.

Unit Price Work

Work to be paid for on the basis of unit prices.

Work

The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

Work Change Directive

A written directive to Contractor, issued on or after the Effective Date of the Agreement and signed by the Engineer, ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed or emergencies. Work Change Directive will not change the Contract Price or Contract Time but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

2. PRELIMINARY MATTERS

2.1. DELIVERY OF BONDS AND CERTIFICATES OF INSURANCE

When Contractor delivers the executed Agreements to the Owner, Contractor shall also deliver to the Owner such Bonds and Certificates of Insurance as Contractor may be required to furnish by this contract.

2.2. COPIES OF DOCUMENTS

Engineer shall furnish to Contractor one (1) copy of Contract Documents for execution. Additional copies will be furnished, upon request, at the cost of reproduction.

2.3. COMMENCEMENT OF CONTRACT TIME/NOTICE TO PROCEED, STARTING THE PROJECT

The Contract Time will commence on the day indicated in the Notice to Proceed. Contractor shall start to perform the work on the date the Contract Time commences to run. No work shall be done at the site prior to the date that the Contract Time commences to run. Pursuant to Section 255.05(1)(b), Florida Statutes, the Notice to Proceed cannot be issued until Contractor provides City with a certified copy of the recorded bond issued by the Pinellas County Clerk of Court.

2.4. BEFORE STARTING CONSTRUCTION

Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error or

discrepancy which Contractor may discover; and shall obtain a written interpretation or clarification from Engineer before proceeding with any work effected thereby; however, Contractor shall not be liable to the Owner for failure to report any conflict, error or discrepancy in the Drawings or Specifications, unless Contractor had actual knowledge thereof or should reasonably have known thereof.

No verbal agreement or conversation with any officer, Agent or employee of the Owner or Engineer's Consultant, either before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained. Contractor shall not commence any work at any time without approved insurance required by these General Conditions. Failure to obtain this insurance will be the sole responsibility of the Contractor.

2.5. PRECONSTRUCTION CONFERENCE

After Contract has been fully executed and before the start of the Work, the Owner's Representative shall schedule a preconstruction conference to be attended by Contractor, Engineer, Owner and others as appropriate to establish a working understanding among the parties as to the Work and to discuss the schedule of the Work and general Contract procedures.

The Contractor shall submit to the Owner's Representative prior to the Notice to Proceed, a color Critical Path Method (CPM) Construction Schedule. This is to be a sequence of events including submittal review and procurement. Notice to Proceed is usually established at the preconstruction conference and such date can be inserted into the schedule at that time. The Contractor shall also submit a Submittal Schedule for review by the Engineer. This is to make sure that the list is complete, and this schedule shall be the basis of a Submittal Log.

The Contractor shall submit to the Owner's Representative prior to the Notice to Proceed, a completed Emergency Call List, a completed Authorized Signature List, and Verification of Illegal Discharge Construction Site Training.

2.6. PROGRESS MEETINGS

The Contractor is required to attend Progress Meetings. These meetings will be scheduled on a weekly, bi-weekly, or monthly basis depending on the needs of the project. The Contractor shall bring to each meeting an updated submittal log, an updated request for information (RFI) log, a look-ahead schedule to cover the project activity from the current meeting to the next meeting, and all material test reports generated in the same time period.

3. CONTRACT DOCUMENTS, INTENT

3.1. INTENT

The Contract Documents comprise the entire Agreement between Owner and the Contractor concerning the Work. They may be altered only by written agreement. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment which may reasonably be inferred from the Contract Documents or from prevailing custom or from trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for. When words or phrases, which have a well-known technical or construction industry or trade meaning, are used to describe Work, materials or equipment, such words or phrases shall be interpreted in accordance with that meaning. Clarifications and

interpretations of the Contract Documents shall be issued by the Owner's Representative. Reference to standards, specifications, manuals or codes of any technical society, organization or association, or to the code, Laws or Regulation of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual or code, or Laws or Regulations in effect at the time of opening of Bids except as may be otherwise specifically stated in the Contract Documents. However, no provision of any referenced standard specification, manual or code, whether or not specially incorporated by reference in the responsibilities of Owner or Contractor as set forth in the Contract Documents, shall change the duties and responsibilities of Owner, Contractor, Engineer or Owner's Representative, or any of their Agents or employees from those set forth in the Contract Documents. Clarifications and interpretations of the Contract shall be issued by the Owner's Representative. Each and every provision of law and clause required by law to be inserted in these Contract documents shall be deemed to be inserted herein, and they shall be read and enforced as through it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be physically amended to make such insertion.

3.2. REPORTING AND RESOLVING DISCREPANCIES

If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the Work or of any such standard, specification, manual or code or of any instruction of any Supplier, Contractor shall report it to the Owner's Representative in writing at once, and Contractor shall not proceed with the Work affected thereby (except in an emergency) until an amendment or supplement to Contract Documents has been issued by one of the methods provided in these General Specifications, provided however, that Contractor shall not be liable to Owner, or Owner's Representative for failure to report any such conflict, error, ambiguity or discrepancy unless Contractor knew or reasonably should have known thereof.

4. AVAILABILITY OF LANDS, SUBSURFACE AND PHYSICAL CONDITIONS, REFERENCE POINTS

4.1. AVAILABILITY OF LANDS

The Owner shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be Performed, rights-of-way, easements, rights of entry for access thereto, and such other lands which are designated for the use of Contractor. The Owner shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which Contractor will have to comply in performing the Work. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by the Owner, unless otherwise provided in the Contract Documents.

4.2. INVESTIGATIONS AND REPORTS

Reference is made to the Supplementary Conditions and Technical Specifications for identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which have been relied upon by Engineer in preparation of the Drawings and Specifications. Such reports are not guaranteed as to accuracy or completeness and are not part of the Contract Documents. Contractor shall promptly

notify the Owner's Representative in writing of any subsurface or latent physical conditions at the site, or in an existing structure, differing materially from those indicated or referred to in the Contract Documents. Engineer will promptly review those conditions and advise if further investigation or tests are necessary. Owner or Engineer shall obtain the necessary additional investigations and tests and furnish copies to the Engineer and Contractor. If Engineer finds that the results of such investigations or tests indicate that there are subsurface or latent physical conditions, which differ materially from those, indicated in the contract Documents, and which could not reasonably have been anticipated by Contractor, a work change, or Change Order will be issued incorporating the necessary revisions.

4.3. PHYSICAL CONDITIONS, UNDERGROUND FACILITIES

The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities or by others. Unless otherwise expressly provided in the Contract Documents, Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and the cost of all the following will be included in the Contract Price and Contractor shall have full responsibility for: (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, and (iv) the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work. The Contractor is required to call the Sunshine State One Call of Florida prior to any excavation per State regulations and to notify any utility owners who are not a member of the Sunshine State One Call of Florida prior to any excavation. The Sunshine State One Call of Florida is an agency for the protection and location of utilities prior to any excavation and contact number is available in local telephone directory.

4.4. REFERENCE POINTS

Engineer shall provide engineering surveys to establish reference points for construction, which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, unless otherwise noted in the Contract, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of the Owner and Engineer. Contractor shall report to Engineer whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations and shall be responsible for the accurate replacement or relocation of such reference points by a surveyor licensed in the State of Florida. The Contractor is referred to the Technical Specifications for more specific information regarding the provision of construction surveys. If a City survey crew is assigned to the project and there is excessive stake replacement caused by negligence of Contractor's forces after initial line and grade have been set, as determined by the Engineer, the Contractor will be charged at the rate of $200.00 per hour. Time shall be computed for actual time on the project. All time shall be computed in one-hour increments with a minimum charge of one hour.

5. BONDS AND INSURANCE

5.1. PERFORMANCE AND PAYMENT BOND/CONTRACT BOND

Contractor shall furnish a Performance and Payment Bond pursuant to Section 255.05, Florida Statutes in an amount equal to the Contract Price as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. This bond shall remain in effect at least one year after the date when final payment becomes due unless a longer period of time is prescribed by laws and regulations or by the Contract Documents. Contractor shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the form prescribed by the Contract Documents in Section V and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. All bonds signed by an agent must be accompanied by a certified copy of such agents' authority to act. All bonds shall be deemed to contain all of the Conditions of Section 255.05, Florida Statutes, even if such language is not directly contained within the bond and the Surety shall be licensed and qualified to do business in the State of Florida. Owner reserves the right to reject any surety. If the Surety on any Bond furnished by the Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of these Contract Documents, the Contractor shall within five days after notice thereof substitute another Bond and surety, both of which must be acceptable to Owner.

5.2. INSURANCE REQUIREMENTS

The Contractor shall, at its own cost and expense, acquire and maintain (and cause any Subcontractors, representatives or agents to acquire and maintain) during the term with the City, sufficient insurance to adequately protect the respective interest of the parties. Coverage shall be obtained with a carrier having an AM Best Rating of A-VII or better. In addition, the City has the right to review the Contractor's deductible or self-insured retention and to require that it be reduced or eliminated.

Specifically, the Contractor must carry the following minimum types and amounts of insurance on an occurrence basis or in the case of coverage that cannot be obtained on an occurrence basis, then coverage can be obtained on a claims-made basis with a minimum four (4) year tail following the termination or expiration of this Agreement:

The following insurance limits may be achieved by a combination of primary and umbrella/excess liability policies.

5.2.1. COMMERCIAL GENERAL LIABILITY INSURANCE

Commercial General Liability Insurance coverage, including but not limited to, premises operations, products/completed operations, products liability, contractual liability, advertising injury, personal injury, death, and property damage in the minimum amount of $1,000,000 (one million dollars) per occurrence and $2,000,000 (two million dollars) general aggregate.

5.2.2. COMMERCIAL AUTOMOBILE LIABILITY INSURANCE

Commercial Automobile Liability Insurance coverage for any owned, non-owned, hired or borrowed automobile is required in the minimum amount of $1,000,000 (one million dollars) combined single limit.

5.2.3. WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE

Statutory Workers' Compensation Insurance coverage in accordance with the laws of the State of Florida, and Employer's Liability Insurance in the minimum amount of $100,000 (one hundred thousand dollars) each employee each accident, $100,000 (one hundred thousand dollars) each employee by disease and $500,000 (five hundred thousand dollars) aggregate by disease with benefits afforded under the laws of the State of Florida. Coverage should include Voluntary Compensation, Jones Act, and U.S. Longshoremen's and Harbor Worker's Act coverage where applicable. Coverage must be applicable to Employees, Contractors, Subcontractors, and Volunteers, if any.

5.2.4. PROFESSIONAL LIABILITY/MALPRACTICE/ERRORS OR OMISSIONS INSURANCE

Professional Liability/Malpractice/Errors or Omissions Insurance coverage appropriate for the type of business engaged in by the Contractor with minimum limits of $1,000,000 (one million dollars) per occurrence. If a claims-made form of coverage is provided, the retroactive date of coverage shall be no later than the inception date of claims-made coverage, unless prior policy was extended indefinitely to cover prior acts. Coverage shall be extended beyond the policy year either by a supplemental extended reporting period (ERP) of as great a duration as available, and with no less coverage and with reinstated aggregate limits, or by requiring that any new policy provide a retroactive date no later than the inception date of claims-made coverage.

5.2.5. CONTRACTOR'S EQUIPMENT/INLAND MARINE/PROPERTY INSURANCE

If Contractor is using its own property in connection with the performance of its obligations under this Agreement, then Contractor's Equipment–Inland Marine Insurance and/or Property Insurance on an "All Risks" basis with replacement cost coverage for property and equipment in the care, custody and control of others is recommended. City is not responsible for Contractor's (or any Subcontractors, Representatives, or Agents) equipment or property.

5.2.6. BUILDER'S RISK INSURANCE

The City will provide at its expense, Builder's Risk Insurance for the project to cover all risks of loss in the complete and full value of the project. Contractor agrees to cooperate in a timely manner with providing any information or documentation required for the application and by the carrier as the project proceeds.

5.3. OTHER INSURANCE PROVISIONS

Upon approval of this Agreement by City Council, and then annually upon the anniversary date(s) of the insurance policy's renewal date(s) for as long as this Agreement remains in effect, the Contractor will furnish the City with a Certificate of Insurance(s) (using appropriate ACORD certificate, SIGNED by the Issuer, and with applicable endorsements) evidencing all of the

coverage set forth above and naming the City as an "Additional Insured." In addition, when requested in writing from the City, Contractor will provide the City with certified copies of all applicable policies. The address where such certificates and certified policies shall be sent or delivered is as follows:

Attn: Contract and Procurement Specialist
City of Clearwater
Engineering Department
P.O. Box 4748
Clearwater, FL 33758-4748

1. The **Description** (of Operations/Locations/Vehicles) should specify Project Name and Project Number.
2. Contractor shall provide thirty (30) days written notice of any cancellation, non-renewal, termination, material change or reduction in coverage.
3. Contractor's insurance as outlined above shall be primary and non-contributory coverage for Contractor's negligence.
4. Contractor reserves the right to appoint legal counsel to provide for the Contractor's defense, for any and all claims that may arise related to Agreement, work performed under this Agreement, or to Contractor's design, equipment, or service. Contractor agrees that the City shall not be liable to reimburse Contractor for any legal fees or costs as a result of Contractor providing its defense as contemplated herein.

The stipulated limits of coverage above shall not be construed as a limitation of any potential liability to the City, and the City's failure to request evidence of this insurance shall not be construed as a waiver of Contractor's (or Subcontractors, Representatives, or Agents) obligation to provide the insurance coverage specified.

5.4. WAIVER OF RIGHTS

The Owner and Contractor intend that all policies purchased in accordance with Article on Insurance will protect the Owner, Contractor, Subcontractors, Engineer, Engineer's Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insured or additional insured in such policies and will provide primary coverage for all losses and damages caused by the perils covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insured or additional insured thereunder, the Owner and Contractor waive all rights against each other and their respective officers, directors, employees and agents for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the work; and, in addition, waive all such rights against Subcontractors, Engineer, Engineer's Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insured or additional insured under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance otherwise payable under any policy so issued. In addition, the Owner waives all rights against Contractor, Subcontractors, Engineer, Engineer's Consultant and the officers, directors, employees and agents of any of them for: (i) loss due to business interruption, loss of use or other consequential loss extending beyond direct physical loss or damage to the Owner property or the Work caused by, arising out of or resulting from fire or other peril, whether or not insured by the Owner and; (ii) loss or damage to the completed Project or part thereof caused by, arising out of or resulting from fire or other insured peril covered by any property insurance maintained on the completed Project or part thereof by the Owner during partial utilization, after substantial completion or after final payment.

6. CONTRACTOR'S RESPONSIBILITIES

6.1. SUPERVISION AND SUPERINTENDENCE

Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of others in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

Contractor shall be responsible to see that the completed work complies accurately with the Contract Documents. Contractor shall keep on the work at all times during its progress a competent resident superintendent, who shall not be replaced without notice to the Owner's Representative except under extraordinary circumstances. The superintendent will be Contractor's representative at the site and shall have authority to act on behalf of Contractor. All communications to the superintendent shall be as binding as if given to Contractor. The Contractor's superintendent shall keep a mobile cell phone on his person, so he can be contacted whenever necessary.

Contractor shall employ only competent persons to do the work and whenever the Owner's Representative shall notify Contractor, in writing, that any person on the work appears to be incompetent, unfaithful, disorderly, disrespectful or otherwise unsatisfactory, such person shall be removed from the project and shall not again be employed on it except with the written consent of the Owner's Representative. Contractor represents the City of Clearwater and shall conduct themselves in a professional manner to the public at all times.

Contractor shall reimburse Owner for additional engineering and inspection costs incurred as a result of overtime work in excess of the regular working hours or on the Owner normally approved holidays. At such times when Inspector overtime is required, the Contractor shall sign an overtime slip documenting such hours and the Contractor shall be provided a copy for his records. At the end of the project and prior to payment of withheld retainage funds, the Contractor shall deliver to the Owner a check made out to the Owner of Clearwater for full reimbursement of all Inspector overtime hours. Withheld retainage shall not be released until the Owner has received this check. Minimum number of chargeable hours for inspection costs on weekends or holidays shall be four hours. The cost of overtime inspection per hour shall be $80.00 per hour.

Contractor shall provide and maintain in a neat and sanitary condition, such sanitary accommodations for the use of Contractor's employees as may be necessary to comply with the requirements of Laws and Regulations and the Engineer.

6.2. LABOR, MATERIALS AND EQUIPMENT

Contractor shall provide competent, suitably qualified personnel to survey, lay out and construct the work as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the site. Except as otherwise required for the safety or protection of persons or the work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all work at the site shall be performed during regular working hours. Contractor shall adhere to the Community Development Code, Section 3-1508 regarding noise restrictions from 6:00 p.m. to 7:00 a.m. any day and all-day Sunday. Contractor will not permit overtime work or the performance of work on Saturday, Sunday, or any legal holiday without Owner consent given after prior notice to Engineer.

Unless otherwise specified in the General Requirements, Contractor shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

All materials and equipment installed in the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the quality of materials and equipment. The Contractor shall provide suitable and secure storage for all materials to be used in the Work so that their quality shall not be impaired or injured. Materials that are improperly stored, may be rejected by the Engineer without testing.

All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier, or distributor, except as otherwise provided in the Contract Documents.

The City of Clearwater, at its sole discretion, reserves the right to purchase major equipment or materials to be incorporated into the Work under the Owner Direct Purchase (ODP) Option, per Section III, Article 21. In such event, the Contractor shall cooperate and assist the Owner of Clearwater, at no additional cost, to implement the ODP documents and procedures.

6.3. SUBSTITUTES AND "OR EQUAL" ITEMS

Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or "or equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by Engineer. If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer for approval. If in the Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or equal" item, it may be considered as a proposed substitute item. Contractor shall submit sufficient information as required by the Engineer to allow the Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and is an acceptable substitute, therefore. Request for review of proposed substitute and "or equal" will be not be accepted by Engineer from anyone other than Contractor.

Request for substitute and "or equal" items by Contractor must be submitted in writing to Owner’s Representative and will contain all information as Engineer deems necessary to make a determination. Request for substitute shall identify why a substitute is submitted and include advantages to the Owner. All data provided by Contractor in support of any proposed substitute or "or equal" item will be at Contractor's expense. Engineer will be allowed a reasonable time to evaluate each proposal or submittal made per this paragraph. Engineer will be sole judge of acceptability.

6.4. SUBCONTRACTORS, SUPPLIERS AND OTHERS

The Contractor shall deliver to the Owner’s Representative before or at the preconstruction conference a list of all Subcontractors, suppliers and other persons and organizations proposed by the Contractor for Work to be performed on the Project. The Contractor shall include with this list

the qualifications and references for each Subcontractor, supplier or other person and organization for review and approval. Any changes to this list must be submitted to the Owner's Representative for approval prior to the substitution of any Subcontractors, suppliers or other persons and organizations before performing any Work on the Project for the Contractor.

Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers and other persons performing or furnishing any of the work under a direct or indirect contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person any contractual relationship between Owner or Engineer and any Subcontractor, Supplier or other person, nor shall it create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers and other persons performing or furnishing any of the work under a direct or indirect contract with Contractor. Contractor shall require all Subcontractors, Suppliers and such other persons performing or furnishing any of the work to communicate with the Engineer through Contractor.

The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the work among Subcontractors or Suppliers or delineating the work to be performed by any specific trade.

All work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

Contractor shall not pay or employ any Subcontractor, Supplier or other person or organization whether initially or as a substitute, against whom Owner or Engineer may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the work against whom Contractor has reasonable objection.

Owner or Engineer will not undertake to settle any differences between Contractor and his Subcontractors or between Subcontractors.

6.5. USE OF PREMISES

Contractor shall confine construction equipment, the storage of materials and equipment and the operations of works to the site and land areas identified in and permitted by the Contract Documents on other land areas permitted by Laws and Regulations, right-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceed in or at law. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, Engineer's Consultant and their officials, directors, employees and agents from and against all claims, costs, losses and damages arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against Owner,

Engineer or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

During the progress of the Work, Contractor shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work or at intervals established by the Engineer, Contractor shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. Contractor shall restore to original condition all property not designated for alteration by the Contract Documents.

6.5.1. STAGING AREAS

The Contactor shall obtain and deliver to the City written permission for the use of all staging and storage areas outside of the Limits of Construction. Use of right of way within the limits of construction must be approved by the City. All applicable erosion control, tree barricade and restoration, including time limits, specifications, etc., must be followed. Contractor must provide portable restroom that is lockable for the safety of the Contractor and the surrounding residents.

6.5.2. RESTORATION TIME LIMITS

The timely restoration of all impacted areas, especially in the Right-of-Ways, is very important to the Citizens of Clearwater therefore, these time limits are imposed:

- Debris piles shall be removed within five (5) consecutive calendar days.
- Concrete driveways and sidewalks shall be replaced within ten (10) consecutive calendar days of removal. Resident access shall be maintained at all times.
- All arterial and collector roadways shall be restored ASAP.
- Local streets and asphalt driveways shall be restored as soon as a sufficient quantity is generated, however, this is never to exceed fifteen (15) consecutive calendar days. Local and resident access shall be maintained at all times.
- Any irrigation systems or components damaged or impacted by construction activities shall be repaired or replaced “in-kind” within forty-eight (48) hours to minimize the loss of turfgrass or landscape plantings, particularly during periods of drought.
- Sod must be restored “in-kind” within fourteen (14) consecutive calendar days of a successful pipe pressure test, removal of concrete forms, backfill of excavations, replacement of driveways or sidewalks or another project specific milestone. It must be watered for a period of thirty (30) days after it is placed. Erosion control and dust control of denuded areas must be maintained at all times.

If the project or a portion of it does not involve right-of ways, then a different schedule of sod restoration may be considered.

6.6. LICENSE AND PATENT FEES, ROYALTIES AND TAXES

Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the work and if to the actual knowledge of Owner or Engineer its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner or Engineer in the Contract Documents.

To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Engineer, Engineer's Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

Contractor shall pay all sales, consumer, use, and other taxes required to be paid by Contractor in accordance with the Laws and Regulations of the State of Florida and other governmental agencies, which are applicable during the performance of the work.

6.7. LAWS AND REGULATIONS

Contractor shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Owner's Representative shall be responsible for monitoring Contractor's compliance with any Laws or Regulations. If Contractor performs any work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses and damages caused by or arising out of such work: however, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations to the Owner to report and resolve discrepancies as described above.

6.7.1. E-VERIFY

Contractor and its Subcontractors shall register with and use the E-Verify system to verify the work authorization status of all newly hired employees. Contractor will not enter into a contract with any Subcontractor unless each party to the contract registers with and uses the E-Verify system. Subcontractor must provide Contractor with an affidavit stating that Subcontractor does not employ, contract with, or subcontract with an unauthorized alien. Contractor shall maintain a copy of such affidavit.

The City may terminate this Contract on the good faith belief that Contractor or its Subcontractors knowingly violated Florida Statutes 448.09(1) or 448.095(2)(c). If this Contract is terminated pursuant to Florida Statute 448.095(2)(c), Contractor may not be awarded a public contract for at least 1 year after the date of which this Contract was terminated. Contractor is liable for any additional costs incurred by the City as a result of the termination of this Contract.

See Section 448.095, Florida Statutes (2020).

See "VERIFICATION OF EMPLOYMENT ELIGIBILITY FORM" in Appendix.

6.8. PERMITS

Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. The Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids. Contractor shall pay all charges of utility owners for connections to the work, and the Owner shall pay all charges of such utility owners for capital costs related thereto such as plant investment fees.

Unless otherwise stated in the Contract Documents, Clearwater Building Permit Fees will be waived.

6.9. SAFETY AND PROTECTION

Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to: (i) all persons on the work site or who may be affected by the work, (ii) all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and (iii) other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction. In the event of temporary suspension of the work, or during inclement weather, or whenever Owner's Representative may direct; Contractor shall, and shall cause Subcontractors, to carefully protect the Work and materials against damage or injury from the weather. If, in the opinion of the Owner's Representative, any portion of Work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any Subcontractors to so protect the Work, such Work and materials shall be removed and replaced at the expense of Contractor. The Contractor shall initiate and maintain an accident prevention program which shall include but shall not be limited to the establishment and supervision of programs for the education and training of employees in the recognition, avoidance and prevention of unsafe conditions and acts. Contractor shall provide first aid services and medical care to his employees. The Contractor shall develop and maintain an effective fire protection and prevention program and good housekeeping practices at the site of contract performance throughout all phases of construction, repair, alteration, or demolition. Contractor shall require appropriate personal protective equipment in all operations where there is exposure to hazardous conditions. The Engineer may order that the work stop if a condition of immediate danger to the Owner's employees, equipment or if property damage exists. This provision shall not shift responsibility or risk of loss for injuries of damage sustained from the Contractor to Owner, and the Contractor shall remain solely responsible for compliance with all safety requirements and for the safety of all persons and property at the site of Contract performance. The Contractor shall instruct his employees required to handle or use toxic materials or other harmful substances regarding their safe handling and use. The Contractor shall take the necessary precautions to protect pedestrians and motorists from harm, and to prevent disruptions of such traffic due to construction activity.

Contractor shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property and to protect them from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and utility owners when execution of the work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury or loss to any property caused, directly or indirectly, in whole or part, by Contractor, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the work or anyone for whose acts any of them may be liable, shall be remedied by Contractor. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor that the Work is acceptable.

6.10. EMERGENCIES

In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, with or without special instruction or authorization from Owner or the Owner's Representative, is obligated to act to prevent damage, injury or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If the Owner's Representative determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued to document the consequences of such action.

6.11. DRAWINGS

6.11.1. SHOP DRAWINGS, SAMPLES, RFIs, AND SUBMITTAL REVIEW

Contractor shall submit Shop Drawings to Engineer for review and approval as called for in the Technical Specifications or required by the Engineer. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show Engineer the materials and equipment Contractor proposes to provide and to enable Engineer to review the information. Contractor shall also submit Samples to Engineer for review and approval. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified: (i) all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto, (ii) all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work, and (iii) all information relative to Contractor's sole responsibilities in respect to means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto. Contractor shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples with the requirements of the Work and the Contract Documents. Each submittal will have a transmittal cover sheet identifying the shop drawing name, number, and technical specification reference; will bear a stamp or specific written indication that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal. At the time of submission, Contractor shall give Engineer specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to Engineer for review and approval of each such variation.

The Contractor shall maintain a submittal log as mentioned in Article 2.5. The Engineer shall receive updated copies at each progress meeting, and the Engineer shall respond to each submittal within fourteen (14) consecutive calendar days. The Contractor shall maintain a request for information (RFI) log as mentioned in Article 2.5. The Engineer shall receive updated copies at each progress meeting, and the Engineer shall respond to each RFI within fourteen (14) consecutive calendar days. The untimely submission of Submittal or RFIs shall not be grounds for a delay claim from the Contractor.

Engineer's review and approval of Shop Drawings and Samples will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of

the completed Project as a functioning whole as indicated the Contract Documents. Engineer's review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means method, technique, sequence or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

Engineer's review and approval of Shop Drawings or Samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to each such variation at the time of submission and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by the Engineer relieve the Contractor from responsibility for complying with the requirements of paragraph above discussing field measurements by the Contractor.

Contractor shall furnish required submittals with complete information and accuracy in order to achieve required approval of an item within two (2) submittals. Owner’s Representative reserves the right to back charge Contractor, for Engineer’s costs for resubmittals that account for a number greater than twenty percent (20%) of the total number of first-time submittals, per the approved initial submittal log. Owner’s Representative reserves the right to back charge Contractor for all third submittals. The number of first-time submittals shall be equal to the number of submittals agreed to by Engineer and Contractor. All costs to Engineer involved with subsequent submittal of Shop Drawings, Samples or other items requiring approval will be back charged to Contractor at the rate of 3.0 times direct technical labor cost by deducting such costs from payments due Contractor for Work completed. In the event, that Contractor requests a substitution for a previously approved item, all of Engineer’s costs in the reviewing and approval of the substitution will be back charged to Contractor, unless the need for such substitution is beyond the control of Contractor.

6.11.2. AS-BUILT DRAWINGS

The Contractor shall keep and maintain one set of blueprints, As-Built Drawings, in good order and legible condition to be continuously marked-up at the job site. The Contractor shall mark and annotate neatly and clearly all project conditions, locations, configurations and any other changes or deviations which may vary from the details represented on the original Contract Plans, including revisions made necessary by Addenda, Shop Drawings, and Change Orders during the construction process. The Contractor shall record the horizontal and vertical locations, in the plan and profile, of all buried utilities that differ from the locations indicated or which were not indicated on the Contract Plans and buried (or concealed), construction and utility features which are revealed during the construction period. All abandoned during construction pipes and utilities must be clearly identified on the As-Builts including the methods used to abandon.

The As-Built Drawings shall be available for inspection by the Engineer, Engineer’s Consultant, and the Owner’s Representative at all times during the progress of the Project.

The As-Built Drawings shall be reviewed by the Owner’s Representative, or his designee, for accuracy and compliance with the requirements of “As-Built Drawings” prior to submittal of the monthly pay requests. The pay requests shall be rejected if the marked-up redline prints do not

conform to the "As-Built Drawings" requirements. As-Built Drawings shall be submitted to the Owner Inspector for approval upon completion of the project and prior to acceptance of final pay request. Final pay request shall not be processed until As-Built Drawings have been reviewed by the Engineer or the Engineer's Consultant for accuracy and completeness.

Prior to placing new potable water mains in service, the Contractor shall provide the Engineer intersection drawings, as specified for the water mains.

The Owner's acceptance of the As-Built Drawings does not relieve the Contractor of the sole responsibility for the accuracy and completeness of the As-Built Drawings.

6.11.2.1. General

The Contractor shall prepare an AS-BUILT SURVEY per chapter 5J-17.052, Florida Administrative Code (see definition below), signed and sealed by a Florida registered land surveyor. The Contractor will deliver to the Owner two hard copies of signed and sealed As-Built Drawings and an AutoCAD file.

***5J-17.050 Definition**: (10)(a) As-Built Survey: a survey performed to obtain horizontal and/or vertical dimensional data so that constructed improvements may be located and delineated: also known as Record Survey.*

This survey shall be clearly titled "AS-BUILT SURVEY" and shall be signed and sealed by a Florida registered land surveyor. The survey must be delivered to the Owner of Clearwater Construction Division upon substantial completion of the project. If this condition is not met, the Owner will procure the services of a Professional Surveyor and Mapper registered in the State of Florida and will back charge the Contractor a fee of $1,800 per day or any portion thereof to provide the Owner with the required As-Built Survey.

6.11.2.2. Sanitary and Storm Sewer Piping Systems

1. Manholes and inlets shall be located by survey coordinates (northing, easting, and elevation) based on the approved horizontal and vertical datum or utilize the stationing supplied on the construction plans. New and replaced service connections shall be dimensioned to the nearest downstream manhole. All manholes, cleanouts and catch basin invert and rim elevations, manhole and catch basin dimensions, pipe sizes, and pipe material shall also be noted on the plan view and also on the profile if one exists. The terminal ends of all subdrains, inverts of all pipe in structures, and the flow line of inlets shall also be noted on the plan view and also on the profile if one exists.
2. Pipe materials and areas of special construction shall be noted.

6.11.2.3. Pressure Pipe construction (Water, Reclaimed Water, Force Main)

All pipes shall be located by survey coordinates (northing, easting, and elevation) based on the approved horizontal and vertical datum or utilize the stationing supplied on the construction plans. Coordinates shall be at all pipe bends, tees, valves, reducers, and deflections. Also, all new and replaced service connections for potable and reclaimed water will be located as described above. Additionally, there must be survey coordinates no further than 100 feet apart on linear type construction and shall denote top of pipe elevation at those points.

6.11.2.4. Electrical and Control Wiring

The As-Built Drawings shall include all changes to the original Contract Plans. The As-Built Drawings shall also include the size, color, and number of wires and conduit. For projects where this information is too voluminous to be contained on the blueline prints, the Contractor shall prepare supplemental drawings, on same size sheets as the blueline prints, showing the additional conduit runs, 1-line diagrams, ladder diagrams, and other information. The wiring schematic diagrams shall show termination location and wiring identification at each point on the ladder diagram.

6.11.2.5. Horizontal and Vertical Control

The As-Built Survey shall be based on the original datum used for the construction design plans or if required by the Owner the datum shall be referenced to the North American Datum of 1983/90 (horizontal) and the North American Vertical Datum of 1988. The unit of measurement shall be the United States Foot. Any deviation or use of any other datum, (horizontal and or vertical), must be approved by the Owner of Clearwater Engineering Department.

6.11.2.6. Standards

The As-Built Survey shall meet the Minimum Technical Standards per Chapter 5J-17 and the Clearwater CAD STANDARDS set forth below. In addition to locating all improvements that pertain to the As-Built Survey it is the requirement of the Owner to have minimum location points at every change in direction and no more than 100 feet apart on all pressure pipes.

6.11.2.7. Other

The As-Built Drawings shall reflect any differences from the original Contract Plans, in the same level of detail and units of dimensions as the Plans.

6.11.3. CAD STANDARDS

6.11.3.1. Layer Naming

6.11.3.1.1. Prefixes and Suffixes

AB-…	prefix denotes As-Built information
DI-…	prefix denotes digitized or scanned entities
DEMO-…	prefix denotes demolition
P-…	prefix denotes proposed entities – line work and symbols
F-…	prefix denotes future entities (proposed but not part of this contract) - line work and symbols
X-…	prefix denotes existing entities – line work and symbols
… -CANOPY	Suffix denotes tree canopies
…-CL	suffix denotes centerline of road, ditch, swale etc.
…-LN	suffix denotes all linework
…-PT	suffix denotes points from survey data or from design stakeout
…-TX	suffix denotes text – use for all text, no matter the prefix

6.11.3.1.2. Layer Naming Definitions:

BENCH	benchmark, temporary benchmarks
BLDG	buildings, sheds, finished floor elevation

BOC	curbs
BOLLARD	bollards
BRUSH	brush lines
CABLE	cable TV lines and appurtenances
CONCSLAB	concrete slabs
DRIVE	driveways
EASEMENT	easements
EOP	edge of pavement without curbs
FENCE	all fences
FLOW	flow lines
GRADE	grade slopes, grade breaks
GROUND	soft ground (unpaved, unimproved)
HANDRAIL	handrails
HEDGE	hedges
LANDSCAPE	landscape areas
LOT	platted lot lines information
MISC	miscellaneous linework
MONU	property corners, monumentation
PHONE	telephone lines and appurtenances
PROPERTY	property lines information
ROAD	roads
ROW	Right-of-Way information
SEAWALL	seawalls
SHORE	shoreline, water elevation
SWALE	swales
TOB	top of bank
TOE	toe of slope
TRAFFIC	signal poles, control boxes
TREE	trees, bushes, planters
UT-ELEC	power lines and appurtenances
UT-GAS	gas lines and appurtenances
UT-RCW	reclaimed water
UT-SAN	sanitary lines and appurtenances
UT-STM	storm lines and appurtenances
UT-TCOM	telecommunication systems
UT-WAT	potable water lines and appurtenances, sprinklers
WALK	sidewalk
WALL	walls, except seawall

Other layers may be created as required or needed, using above format or easy to understand logic.

6.11.3.2. Layer Properties

All AutoCAD objects shall be drawn with their General Properties to be “ByLayer”, pertaining to “Color”, “Linetype”, and “Lineweight”.

6.11.3.3. Text Styles

All text shall use standard AutoCAD fonts.

Text style for X-… (existing) layers shall use the Simplex font, oblique angle of 0°, and a text height of 0.06 times the plot scale.

Text style for P-… (proposed) and F-… (future) layers shall use the Simplex font, oblique angle of 22.5°, and a text height of 0.1 times the plot scale.

6.11.4. DELIVERABLES

The As-Built Survey shall be produced on bond material, 24" x 36" at a scale of 1"=20’ unless approved otherwise. The consultant shall deliver two hard copies and one digital copy of all drawings. Requested file formats are Autodesk DWG and Adobe PDF files.

Please address any questions regarding format to Mr. Tom Mahony, at (727) 562-4762 or e-mail address Thomas.Mahony@myClearwater.com.

6.12. CONTRACTOR'S GENERAL WARRANTY AND GUARANTEE

Contractor warrants and guarantees to Owner, Engineer and Engineer's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. Contractor's warranty and guarantee hereunder includes defects or damage caused by abuse, vandalism, modification, or operation by persons other than Contractor, Subcontractors or Suppliers. Until the acceptance of the Work by the Owner, the Work shall be under the charge and care of the Contractor, and he shall take every necessary precaution against injury or damage to any part thereof by action of the elements, or from any other cause whatsoever, arising from the execution or non-execution of the Work. The Contractor shall rebuild, repair, and make good, at his own expense, all injuries or damages to any portion of the Work occasioned by any cause before its completion and final acceptance by the Owner. In addition, “the Contractor shall remedy any defects in the work at his own expense and pay for any damage to other work resulting therefrom which appear within a period of one year from the date of final acceptance”.

Contractor's warranty and guarantee hereunder excludes improper maintenance and operation by Owner's employees and normal wear and tear under normal usage for any portion of the Work, which has been partially accepted by the Owner for operation prior to final acceptance by the Owner. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents: (i) observations by Owner’s Representative, (ii) recommendation of any progress or final payment by Owner’s Representative, (iii) the issuance of a certificate of Substantial Completion or any payment by the Owner to contractor under the Contract Documents, (iv) use or occupancy of the Work or any part thereof by Owner, (v) any acceptance by Owner or any failure to do so, (vi) any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of Acceptance by the Engineer.

6.13. CONTINUING THE WORK

Contractor shall carry on the work and adhere to the progress schedule during all disputes or disagreements with the Owner. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the Owner or Contractor may otherwise agree in writing.

6.14. INDEMNIFICATION

To the fullest extent permitted by law, Contractor agrees to defend, indemnify, and hold the City, its officers, agents, and employees, harmless from and against any and all liabilities, demands, claims, suits, losses, damages, causes of action, fines or judgments, including costs, attorneys', witnesses', and expert witnesses' fees, and expenses incident thereto, relating to, arising out of, or resulting from: (i) the services provided by Contractor personnel under this Agreement; (ii) any negligent acts, errors, mistakes or omissions by Contractor or Contractor personnel; and (iii) Contractor or Contractor personnel's failure to comply with or fulfill the obligations established by this Agreement.

Contractor will update the City during the course of the litigation to timely notify the City of any issues that may involve the independent negligence of the City that is not covered by this indemnification.

The City assumes no liability for actions of Contractor and will not indemnify or hold Contractor or any third party harmless for claims based on this Agreement or use of Contractor-provided supplies or services.

Notwithstanding anything contained herein to the contrary, this indemnification provision shall not be construed as a waiver of any immunity to which Owner is entitled or the extent of any limitation of liability pursuant to § 768.28, Florida Statutes. Furthermore, this provision is not intended to nor shall be interpreted as limiting or in any way affecting any defense Owner may have under § 768.28, Florida Statutes or as consent to be sued by third parties.

6.15. CHANGES IN COMPANY CONTACT INFORMATION

Contractor shall notify Owner by US mail addressed to the City Engineer of any changes in company contact information. This includes contact phone, address, project manager, email addresses, etc.

6.16. PUBLIC RECORDS

The CONTRACTOR will be required to comply with Section 119.0701, Florida Statutes.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS, Rosemarie Call, phone: 727-562-4092 or Rosemarie.Call@myclearwater.com**, 600 Cleveland Street, Suite 600, Clearwater, FL 33755.**

The Contractor's duty to comply with public records law applies specifically to:

a) Keep and maintain public records required by the City of Clearwater (hereinafter "public agency") to perform the service being provided by the Contractor hereunder.
b) Upon request from the public agency's custodian of public records, provide the public agency with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided for in Chapter 119, Florida Statutes, as may be amended from time to time, or as otherwise provided by law.
c) Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the

duration of the contract term and following completion of the contract if the Contractor does not transfer the records to the public agency.

d) Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of the Contractor or keep and maintain public records required by the public agency to perform the service. If the Contractor transfers all public records to the public agency upon completion of the contract, the Contractor shall destroy any public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains public records upon completion of the contract, the Contractor shall meet all applicable requirements for the retaining public records. All records stored electronically must be provided to the public agency, upon request from the public agency's custodian of public records in a format that is compatible with the information technology systems of the public agency.

e) A request to inspect or copy public records relating to a public agency's contract for services must be made directly to the public agency. If the public agency does not possess the requested records, the public agency shall immediately notify the Contractor of the request and the Contractor must provide the records to the public agency or allow the records to be inspected or copied within a reasonable time.

f) The Contractor hereby acknowledges and agrees that if the Contractor does not comply with the public agency's request for records, the public agency shall enforce the contract provisions in accordance with the contract.

g) A Contractor who fails to provide the public records to the public agency within a reasonable time may be subject to penalties under Section 119.10, Florida Statutes.

h) If a civil action is filed against a Contractor to compel production of public records relating to a public agency's contract for services, the court shall assess and award against the Contractor the reasonable costs of enforcement, including reasonable attorney fees, if:
    1. The court determines that the Contractor unlawfully refused to comply with the public records request within a reasonable time; and
    2. At least 8 business days before filing the action, the plaintiff provided written notice of the public request, including a statement that the Contractor has not complied with the request, to the public agency and to the Contractor.

i) A notice complies with subparagraph (h)2. if it is sent to the public agency's custodian of public records and to the Contractor at the Contractor's address listed on its contract with the public agency or to the Contractor's registered agent. Global Express Guaranteed, or certified mail, with postage or shipping paid by the sender and with evidence of delivery, which may be in an electronic format.

j) A Contractor who complies with a public records request within 8 business days after the notice is sent is not liable for the reasonable costs of enforcement.

7. OTHER WORK

7.1. RELATED WORK AT SITE

The City reserves the right to have its own forces enter the construction site at any time and perform work as necessary in order to perform infrastructure repair or maintenance, whether related to the project or not. The Contractor will allow complete access to all utility owners for these purposes.

The City may have its own forces perform new work related to the project, however, this work will be identified in the Contract Scope of Work and coordination will be such that this activity is

denoted in the Contractor's CPM Schedule so as not to cause any delays or interference with the Contractor's work or schedule.

7.2. COORDINATION

If the Owner contracts with others for the performance of other work on the Project at the site, the following will be set forth in the Scope of Work: (i) the person who will have authority and responsibility for coordination of the activities among the various prime Contractors will be identified; (ii) the specific matters to be covered by such authority and responsibility will be itemized; and (iii) the extent of such authority and responsibilities will be provided. Unless otherwise provided in the Supplementary Conditions, the Owner shall have sole authority and responsibility in respect of such coordination.

8. OWNER'S RESPONSIBILITY

Except as otherwise provided in these General Conditions, the Owner shall issue all communications from the Owner to the Contractor through Owner's Representative.

The Owner shall furnish the data required of the Owner under the Contract Documents promptly and shall make payments to Contractor promptly when they are due as provided in these General Conditions.

The Owner is obligated to execute Change Orders as indicated in the Article on Changes In The Work.

The Owner's responsibility in respect of certain inspections, tests, and approvals is set forth in the Article on Tests and Inspections.

In connection with the Owner's right to stop work or suspend work, see the Article on Engineer may Stop the Work. The Article on Suspension of Work and Termination deals with the Owner's right to terminate services of Contractor under certain circumstances.

Owner shall not supervise, direct or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work. The Owner will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

9. OWNER REPRESENTATIVE'S STATUS DURING CONSTRUCTION

9.1. OWNER'S REPRESENTATIVE

Dependent of the project type, the Owner's Representative during the construction period will either be the Construction Manager, the Engineer, or a designee of the Project's Owner. The duties, responsibilities and the limitations of authority of Owner's Representative during construction are set forth in the Contract Documents and shall not be extended without written consent of Owner and Engineer.

9.2. CLARIFICATIONS AND INTERPRETATIONS

Engineer will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents regarding design issues only, in the form of Submittal responses, RFI responses, Drawings or otherwise, as Engineer may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. All other clarifications and interpretations of the Contract Documents shall be issued form the Owner's Representative. Such written clarifications and interpretations will be binding on the Owner and Contractor. If Contractor believes that a written clarification or interpretation justifies an adjustment in the Contract Price or the Contract Time and the parties are unable to agree to the amount or extent thereof, if any, Contractor may make a written claim therefore as provided in the Articles for Change of Work and Change of Contract Time.

9.3. REJECTING OF DEFECTIVE WORK

The Owner's Representative or the Engineer will have authority to disapprove or reject Work which Owner's Representative or the Engineer believes to be defective, or that Owner's Representative or the Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. The Owner's Representative or the Engineer will also have authority to require special inspection or testing of the Work whether or not the Work is fabricated, installed or completed.

9.4. SHOP DRAWINGS, CHANGE ORDERS, AND PAYMENTS

In connection with Engineer's authority as to Shop Drawings and Samples, see articles on Shop Drawings and Samples. In connection with Owner's Representative authority as to Change Orders, see the articles on Changes of Work, Contract Price and Contract Time. In connection with Owner's Representative authority as to Applications for Payment, see the articles on Payments to Contractor and Completion.

9.5. DECISIONS ON DISPUTES

The Owner's Representative will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the work thereunder. Claims, disputes and other matters relating to the acceptability of the work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the work and Claims under the Articles for Changes of Work, Changes of Contract Time and Changes of Contract Price will be referred initially to Owner's Representative in writing with a request for a formal decision in accordance with this paragraph. Written notice of each such claim, dispute or other matter will be delivered by the claimant to Owner's Representative and the other party to the Agreement promptly, but in no event later than thirty (30) days, after the start of the occurrence or event giving rise thereto, and written supporting data will be submitted to Owner's Representative and the other party within sixty (60) days after the start of such occurrence or event unless Owner's Representative allows an additional period of time for the submission of additional or more accurate data in support of such claim, dispute or other matter. The opposing party shall submit any response to Owner's Representative and the claimant within thirty (30) days after receipt of the claimant's last submittal unless Owner's Representative allows additional time. Owner's Representative will render a formal decision in writing within thirty (30) days after receipt of the opposing party's submittal, if any, in accordance with this paragraph. Owner Representative's written decision on such claim, dispute or other matter will be final and binding upon the Owner

and Contractor unless (i) an appeal from Owner Representative's decision is taken within thirty (30) days of the Owner Representative's decision, or the appeal time which may be stated in a Dispute Resolution Agreement between Owner and Contractor for the settlement of disputes or (ii) if no such Dispute Resolution Agreement has been entered into, a written notice of intention to appeal from Owner Representative's written decision is delivered by the Owner or Contractor to the other and to Owner's Representative within thirty (30) days after the date of such decision and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to such claim, dispute or other matter in accordance with applicable Laws and Regulations within sixty (60) days of the date of such decision, unless otherwise agreed in writing by the Owner and Contractor.

When functioning as interpreter and judge, Owner's Representative will not show partiality to the Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by Owner's Representative with respect to any such claim, dispute or other matter will be a condition precedent to any exercise by the Owner or Contractor of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter pursuant the Article on Dispute Resolution.

9.6. LIMITATIONS ON OWNER REPRESENTATIVE'S RESPONSIBILITIES

Neither Owner Representative's authority or responsibility under this paragraph or under any other provision of the Contract Documents nor any decision made by Owner's Representative in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise or performance of any authority or responsibility by Owner's Representative shall create, impose or give rise to any duty owed by Owner's Representative to Contractor, any Subcontractor, any Supplier, any other person or organization or to any surety for or employee or agent of any of them.

Owner's Representative will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the work. Owner's Representative will not be responsible for Contractor's failure to perform or furnish the work in accordance with the Contract Documents.

Owner's Representative will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the work.

Owner Representative's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals and other documentation required to be delivered by the Contractor will only be to determine generally that their content complies with the requirements of the Contract Documents and, in the case of certificates of inspections, tests and approvals that the results certified indicate compliance with the Contract Documents.

The limitations upon authority and responsibility set forth in this paragraph shall also apply to Owner Representative's CEI, the Engineer's Consultants, and assistants.

10. CHANGES IN THE WORK

Without invalidating the Agreement and without notice to any surety, the Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such additions, deletions, or revisions will be authorized by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as may otherwise be specifically provided).

If the Owner and Contractor are unable to agree as to the extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Time that should be allowed as a result of a Work Change Directive, a claim may be made therefore as provided in these General Conditions.

Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in these General Conditions except in the case of an emergency as provided or in the case of uncovering work as provided in article for Uncovering Work.

The Owner and Contractor shall execute appropriate Change Orders or Written Amendments recommended by Owner's Representative covering:

- changes in the work which are (i) ordered by the Owner (ii) required because of acceptance of defective work under the article for Acceptance of Defective Work or correcting defective Work under the article for Owner May Correct Defective Work or (iii) agreed to by the parties;
- changes in the Contract Price or Contract Time which are agreed to by the parties; and
- changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by Owner's Representative pursuant to the article for Decisions on Disputes;
- provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the progress schedule as provided in the article for Continuing the Work.

If notice of any change affecting the general scope of the work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Time) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be Contractor's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

11. CHANGES IN THE CONTRACT PRICE

11.1. CHANGES IN THE CONTRACT PRICE

The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change in the Contract Price. The Contract Price may only be adjusted by a Change Order or by a Written Amendment. Any claim for an adjustment in the Contract Price shall be based on a written notice of claim stating the general nature of the claim, to be delivered by the party making the claim to the other party and to Owner's Representative or promptly (but in no event later than thirty days) after the start of the occurrence or event giving rise to the claim. Notice of the amount of the claim with supporting

data shall be delivered within sixty (60) days after the start of such occurrence or event, unless Owner's Representative allows additional time for claimant to submit additional or more accurate data in support of the claim, and shall be accompanied by claimant's written statement that the claimed adjustment covers all known amounts to which the claimant is entitled as a result of said occurrence or event. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph. The value of any Work covered by a Change Order or of any claim for an adjustment in the Contract Price will be determined as follows: (i) where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (ii) where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit), (iii) where the Work is not covered by unit prices contained in the Contract Documents and agreement is reached to establish unit prices for the Work.

Where the work involved is not covered by unit prices contained in the Contract Documents and where the Owner's Representative, the Owner, the Engineer, the Engineer's Consultant, and Contractor cannot mutually agree on a lump sum price, the City of Clearwater shall pay for directed changes in the Work, on "COST REIMBURSEMENT" basis. The Contractor shall apply for compensation, detailing Contractors forces, materials, equipment, Subcontractors, and other items of direct costs required for the directed work.

The application for Cost Reimbursement shall be limited to the following items:

1. Labor, including foremen, for those hours associated with the direct work (actual payroll cost, including wages, fringe benefits, labor insurance and labor taxes established by law). Expressly excluded from this item are all costs associated with negotiating the subject change.
2. Materials associated with the change, including sales tax. The costs of materials shall be substantiated through vendors' invoices.
3. Rental or equivalent rental costs of equipment, including necessary transportation costs if specifically used for the Work. The rental rates shall not exceed the current rental rates prevailing in the locality or as defined in the rental Rate Blue Book for Construction Equipment (a.k.a. DataQuest Blue Book). The rental rate is defined as the full-unadjusted base rental rate for the appropriate item of construction equipment and shall cover the costs of all fuel, supplies, repairs, insurance, and other costs associated with supplying the equipment for work ordered. Contractor-owned equipment will be paid for the duration of time required to complete the work. Utilize lowest cost combination of hourly, daily, weekly, or monthly rates. Do not exceed estimated operating costs given in Blue Book. Operating costs will not be allowed for equipment on stand-by.
4. Additional costs for Bonds, Insurance if required by the City of Clearwater.

The following fixed fees shall be added to the costs of the directed work performed by the Contractor or Subcontractor.

A. A fixed fee of fifteen percent (15%) shall be added to the costs of Item 1 above. If work is performed by a Subcontractor, the Contractor's fee shall not exceed five percent (5%), and the Subcontractor's fee shall not exceed ten percent (10%).

B. A fixed fee of ten percent (10%) shall be added to the costs of Item 2 above.

C. No markup shall be added to the costs of Items 3 and 4.

The fixed fees shall be considered the full compensation for all cost of general supervision, overhead, profit, and other general expense.

11.2. ALLOWANCES AND FINAL CONTRACT PRICE ADJUSTMENT

It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be furnished and performed for such sums as may be acceptable to Owner and Engineer. Contractor agrees that: (i) the allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and (ii) Contractor's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances and no demand for additional payment on account of any of the foregoing will be valid.

Prior to final payment, an appropriate Change Order will be issued as recommended by Owner's Representative to reflect actual amounts due Contractor on account of Work covered by allowances and all the Work actually performed by the Contractor, and the Contract Price shall be correspondingly adjusted.

11.3. UNIT PRICE WORK

Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit price for each separately identified item of unit price work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Owner's Representative. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item. The Owner or Contractor may make a claim for an adjustment in the Contract Price if: (i) the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Contract Documents; and (ii) there is no corresponding adjustment with respect to any other item of Work; and (iii) if Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or the Owner believes that the Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease. On unit price contracts, Owner endeavors to provide adequate unit quantities to satisfactorily complete the construction of the project. It is expected that in the normal course of project construction and completion that not all unit quantities will be used in their entirety and that a finalizing change order which adjusts contract unit quantities to those unit quantities actually used in the construction of the project will result in a net decrease from the original Contract Price. Such reasonable deduction of final Contract Price should be anticipated by the Contractor in his original bid.

12. CHANGES IN THE CONTRACT TIME

The Contract Time (or Milestones) may only be changed by a Change Order or a Written Amendment. Any claim for an adjustment of the Contract Time (or Milestones) shall be based on written notice delivered by the party making the claim to the other party and to Owner's Representative promptly, but in no event later than thirty (30) days, after the occurrence of the

event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty (60) days after such occurrence, unless Owner's Representative allows an additional period of time to ascertain more accurate data in support of the claim, and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Time (or Milestones) shall be determined by Owner's Representative. No claim for an adjustment in the Contract Time (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph.

All time limits stated in the Contract Documents are of the essence of the Agreement.

Where Contractor is prevented from completing any part of the work within the Contract Time (or Milestones) due to delay beyond the control of Contractor, the Contract Time (or Milestones) may be extended in an amount equal to the time lost due to such delay if a claim is made therefore as provided in the article for Changes in the

Work. Delays beyond the control of Contractor shall include, but not be limited to, acts by the Owner, acts of utility owners or other contractors performing other work as contemplated by the article for Other Work, fires, floods, epidemics, abnormal weather conditions or acts of God. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

Where Contractor is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both the Owner and Contractor, an extension of the Contract Time (or Milestones) in an amount equal to the time lost due to such delay shall be Contractor's sole and exclusive remedy for such delay. In no event shall the Owner be liable to Contractor, any Subcontractor, any Supplier, any other person, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from (i) delays caused by or within the control of Contractor, or (ii) delays beyond the control of both parties including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God or acts by utility owners or other contractors performing other work as contemplated by paragraph for Other Work.

13. TESTS AND INSPECTIONS, CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.1. TESTS AND INSPECTION

Contractor shall give Owner's Representative and Engineer timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

Contractor shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents. The costs for these inspections, tests or approvals shall be borne by the Contractor except as otherwise provided in the Contract Documents.

If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body including all Owner Building Departments and Owner Utility Departments, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith, and furnish Owner's Representative the required certificates of inspection or approval. Unless otherwise stated in the Contract Documents, Owner

permit and impact fees will be waived. Contractor shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation of the Work.

If any Work (or the work of others) that is to be inspected tested or approved is covered by Contractor without written concurrence of Owner's Representative, it must, if requested by Owner's Representative, be uncovered for observation. Uncovering Work as provided in this paragraph shall be at Contractor's expense unless Contractor has given Owner's Representative and Engineer timely notice of Contractor's intention to cover the same and Owner's Representative has not acted with reasonable promptness in response to such notice.

13.2. UNCOVERING THE WORK

If any Work is covered contrary to the written request of Owner's Representative, it must, if requested by Owner's Representative, be uncovered for Owner Representative's observation and replaced at Contractor's expense.

If Owner's Representative considers it necessary or advisable that covered Work be observed by Owner's Representative or inspected or tested by others, Contractor, at Owner Representative's request, shall uncover, expose or otherwise make available for observation, inspection or testing as Engineer or Owner's Representative may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, Contractor shall pay all claims, costs, losses and damages caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and the Owner shall be entitled to an appropriate decrease in the Contract Price for the costs of the investigation, and, if the parties are unable to agree as to the amount thereof, may make a claim therefore as provided in the article for Change in Contract Price. If, however, such Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, Contractor may make a claim therefore as provided the article for Change in Contract Price and Change of Contract Time.

13.3. OWNER'S REPRESENTATIVE MAY STOP THE WORK

If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, Engineer or Owner's Representative may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner's Representative to stop the Work shall not give rise to any duty on the part of Owner's Representative or Owner to exercise this right for the benefit of Contractor or any surety or other party. If the Owner's Representative stops Work under this paragraph, Contractor shall be entitled to no extension of Contract Time or increase in Contract Price.

13.4. CORRECTION OR REMOVAL OF DEFECTIVE WORK

If required by Engineer or Owner's Representative, Contractor shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has

been rejected by Engineer or Owner's Representative, remove it from the site and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.5. WARRANTY/CORRECTION PERIOD

If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to the Owner and in accordance with the Owner's written instructions; (i) correct such defective Work, or, if it has been rejected by the Owner, remove it from the site and replace it with Work that is not defective and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If Contractor does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, the Owner may have the defective Work corrected or the rejected. Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

In special circumstances where a particular item of equipment is placed in continuous service before Final Completion of all the Work, the correction period for that item may start to run from an earlier date if specifically, and expressly so provided in the Specifications or by Written Amendment.

Where defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this paragraph the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

13.6. ACCEPTANCE OF DEFECTIVE WORK

If, instead of requiring correction or removal and replacement of defective Work, the Owner prefers to accept it, the Owner may do so.

Contractor shall pay all claims, costs, losses, and damages attributable to the Owner's evaluation of and determination to accept such defective Work such costs to be approved by Owner's Representative as to reasonableness. If any such acceptance occurs prior to Owner Representative's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and the Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, the Owner may make a claim therefore as provided in article for Change of Contract Price. If the acceptance occurs after the Owner Representative's recommendation for final payment an appropriate amount will be paid by Contractor to the Owner.

13.7. OWNER MAY CORRECT DEFECTIVE WORK

If Contractor fails within a reasonable time after written notice from Owner's Representative to correct defective Work or to remove and replace rejected Work as required by Owner's Representative in accordance with the article for Correction and Removal of Defective Work or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, the Owner may, after seven

days' written notice to Contractor, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph the Owner shall proceed expeditiously. In connection with such corrective and remedial action, the Owner may exclude Contractor from all or part of the site, take possession of all or part of the Work, and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the site or for which the Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's Representatives, Agents and Employees, the Owner's other contractors, and Owner's Representative, Engineer, and Engineer's Consultants access to the site to enable the Owner to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by the Owner in exercising such rights and remedies will be charged against Contractor and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and the Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, the Owner may make a claim therefore as provided in the article for Change of Contract Price. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of Contractor's defective Work. Contractor shall not be allowed an extension of the Contract Time (or Milestones) because of any delay in the performance of the Work attributable to the exercise by the Owner of the Owner's rights and remedies hereunder.

14. PAYMENTS TO CONTRACTOR AND COMPLETION

Requests for payment shall be processed in accordance with F.S. 218.735 and as described herein. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.1. APPLICATION FOR PROGRESS PAYMENT

Contractor shall submit (not more often than once a month) to Owner's Representative for review an Application for Payment filled out and signed by Contractor covering the Work completed once each month and accompanied by such supporting documentation as is required by the Owner's Representative and the Contract Documents. Unless otherwise stated in the Contract Documents, payment will not be made for materials and equipment not incorporated in the Work. Payment will only be made for that portion of the Work, which is fully installed including all materials, labor, and equipment. A retainage of not less than five (5%) of the amount of each Application for Payment for the total of all Work, including As-Built Survey and Inspector overtime reimbursement, completed to date will be held until final completion and acceptance of the Work covered in the Contract Documents. No progress payment shall be construed to be acceptance of any portion of the Work under contract.

The Contractor shall review with the Engineer or the Construction Inspector all quantities and work for which payment is being applied for and reach agreement prior to submittal of an Official Pay Request. The Engineer or the Construction Inspector will verify that the on-site marked up As-Built Drawings are up to date with the work and are in compliance with the Contract Documents.

In addition to all other payment provisions set out in this contract, the Owner's Representative may require the Contractor to produce for Owner, within fifteen (15) days of the approval of any progress payment, evidence and/or payment affidavit that all Subcontractors and Suppliers have been paid any sum or sums then due. A failure on the part of the Contractor to provide the report as required herein shall result in further progress or partial payments being withheld until the report is provided.

14.2. CONTRACTOR'S WARRANTY OF TITLE

Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to the Owner no later than the time of payment, free and clear of liens. No materials or supplies for the Work shall be purchased by Contractor or Subcontractor subject to any chattel mortgage or under a conditional sale contact or other agreement by which an interest is retained by the seller. Contractor warrants that he has good title to all materials and supplies used by him in the Work, free from all liens, claims or encumbrances. Contractor shall indemnify and save the Owner harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies incurred in the furtherance of the performance of this Contract. Contractor shall at the Owner's request, furnish satisfactory evidence that all obligations of nature hereinabove designated have been paid, discharged, or waived. If Contractor fails to do so, then the Owner may, after having served written notice on said Contractor either pay unpaid bills, of which the Owner has written notice, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged, whereupon payment to Contractor shall be resumed in accordance with the terms of this Contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to the Contractor or the Surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of Contractor and any payment so made by the Owner shall be considered as payment made under the Contract by the Owner to Contractor, and the Owner shall not be liable to Contractor for any such payment made in good faith.

14.3. REVIEW OF APPLICATIONS FOR PROGRESS PAYMENTS

The Owner's Representative will within twenty (20) business days after receipt authorize and process payment by the Owner a properly submitted and documented Application for payment unless the application requires review by an Agent. If the Application for payment requires review and approval by an Agent, properly submitted and documented Applications for payment will be paid by the Owner within twenty-five (25) business days. If an Application for payment is rejected, notice shall be given within twenty (20) business days of receipt indicating the reasons for refusing payment. The reasons for rejecting an Application will be submitted in writing, specifying deficiencies, and identifying actions that would make the Application proper. In the latter case, Contractor may make the necessary corrections and resubmit the Application. The Owner's Representative or Agent may refuse to recommend the whole or any part of any payment to Owner. Owner's Representative or Agent may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or test, nullify any such payment previously recommended, to such extent as may be necessary in Owner Representative's or Agent's opinion to protect the Owner from loss because: (i) the Work is defective, or completed Work has been damaged requiring correction or replacement, (ii) the Contract Price has been reduced by amendment or Change Order, (iii) the Owner has been required to correct defective Work or complete Work, or (iv) Owner's Representative or Agent has actual knowledge of the occurrence of any of the events enumerated in the article on Suspension of Work and Termination.

The Owner may refuse to make payment of the full amount recommended by the Owner's Representative or Agent because: (i) claims have been made against the Owner on account of Contractor's performance or furnishing of the Work, (ii) Liens have been filed in connection with the Work, except where Contractor has delivered a specific Bond satisfactory to the Owner to

secure the satisfaction and discharge of such Liens, (iii) there are other items entitling the Owner to a set-off against the amount recommended, or (iv) the Owner has actual knowledge of any of the events described in this paragraph. The Owner shall give Contractor notice of refusal to pay in accordance with the time constraints of this section with a copy to the Owner's Representative or Agent, stating the reasons for such actions, and Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by the Owner and Contractor, when Contractor corrects to the Owner's satisfaction the reasons for such action.

14.4. PARTIAL UTILIZATION

Use by the Owner at the Owner's option of any substantially completed part of the Work which (i) has specifically been identified in the Contract Documents, or (ii) Owner, Engineer, Owner's Representative, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by the Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, may be accomplished prior to Final Completion of all the Work subject to the following:

The Owner at any time may request Contractor in writing to permit the Owner to use any such part of the Work which the Owner believes to be ready for its intended use and substantially complete. If Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner, Owner's Representative, and Engineer that such part of the Work is substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work. Contractor at any time may notify Owner, Owner's Representative, and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, Owner, Contractor, Owner's Representative, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner, Owner's Representative, and Contractor in writing giving the reasons, therefore. If Engineer considers that part of the Work to be substantially complete, the provisions of the articles for Substantial Completion and Partial Utilization will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.5. FINAL INSPECTION

Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Owner's Representative will make a final inspection with Engineer, Owner and Contractor and will within thirty (30) days notify Contractor in writing of particulars in which this inspection reveals that the Work is incomplete or defective. The Owner's Representative will produce a final punch list, deliver it to the Contractor within five (5) days of completion and assign a date for this work to be completed not less than thirty (30) days from delivery of the list. Failure to include any corrective work or pending items does not alter the responsibility of the Contractor to complete all the construction services purchased pursuant to the contract. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.6. FINAL APPLICATION FOR PAYMENT

After Contractor has completed all such corrections to the satisfaction of Owner's Representative and has delivered in accordance with the Contract Documents all maintenance and operating instructions, As-Built, schedules, guarantees, Bonds, certificates or other evidence of insurance

required by the paragraph for Bonds and Insurance, certificates of inspection, Inspector overtime reimbursement as required in the Contract Documents and other documents, Contractor may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by paragraph for Bonds and Insurance, and (ii) executed consent of the surety to final payment using the form contained in Section V of the Contract Documents.

Prior to application for final payment, Contractor shall clean and remove from the premises all surplus and discarded materials, rubbish, and temporary structures, and shall restore in an acceptable manner all property, both public and private, which has been damaged during the prosecution of the Work and shall leave the Work in a neat and presentable condition.

14.7. FINAL PAYMENT AND ACCEPTANCE

If through no fault of Contractor, final completion of the Work is significantly delayed and if Owner's Representative so confirms, the Owner shall, upon receipt of Contractor's final Application for payment and recommendation of Owner's Representative, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by the Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph for Bonds and Insurance, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Owner's Representative with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that such payment shall not constitute a waiver of claims.

If on the basis of Owner Representative's observation of the Work during construction and final inspection, and Owner Representative's review of the final Application for Payment and accompanying documentation, all as required by the Contract Documents, Owner's Representative is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Owner's Representative will indicate in writing his recommendation of payment and present the Application to Owner for payment. Thereupon, Owner's Representative will give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of this article. Otherwise, Owner's Representative will return the Application to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, the Owner shall, within twenty (20) days after receipt thereof pay Contractor the amount recommended by Owner's Representative.

14.8. WAIVER OF CLAIMS

The making and acceptance of final payment will constitute: a waiver of all claims by the Owner against Contractor, except claims arising from unsettled Liens, from defective Work appearing after final inspection, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and a waiver of all claims by Contractor against the Owner other than those previously made in writing and still unsettled.

15. SUSPENSION OF WORK AND TERMINATION

15.1. OWNER MAY SUSPEND THE WORK

At any time and without cause, Owner's Representative may suspend the Work or any portion thereof for a period of not more than ninety (90) days by notice in writing to Contractor, which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes an approved claim therefore as provided in the articles for Change of Contract Price and Change of Contract Time.

15.2. OWNER MAY TERMINATE

Upon the occurrence of any one or more of the following events:

- Contractor persistently fails to perform the work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule as adjusted from time to time);
- Contractor disregards Laws and Regulations of any public body having jurisdiction;
- Contractor violates Article 6.7.1 of this Section III;
- Contractor disregards the authority of Owner's Representative;
- Contractor otherwise violates in any substantial way any provisions of the Contract Documents; or if the Work to be done under this Contract is abandoned, or if this Contract or any part thereof is sublet, without the previous written consent of the Owner, or if the Contract or any claim thereunder is assigned by Contractor otherwise than as herein specified, or at any time Owner's Representative certifies in writing to the Owner that the rate of progress of the Work or any part thereof is unsatisfactory or that the work or any part thereof is unnecessarily or unreasonably delayed;
- Lack of funding. The City's performance and obligation to pay under this Contract is contingent upon an annual appropriation by the Clearwater City Council.

The Owner may, after giving Contractor (and the surety, if any), seven days' written notice and, to the extent permitted by Laws and Regulations, terminate the services of Contractor, exclude Contractor from the site and take possession of the Work and of all Contractor's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which the Owner has paid Contractor but which are stored elsewhere, and finish the Work as the Owner may deem expedient. In such case Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages sustained by the Owner arising out of or resulting from completing the Work such excess will be paid to Contractor.

If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to the Owner. Such claims, costs, losses and damages incurred by the Owner will be reviewed by Owner's Representative as to their reasonableness and when so approved by Owner's Representative incorporated in a Change Order, provided that when exercising any rights or remedies under this paragraph the Owner shall not be required to obtain the lowest price for the Work performed.

Where Contractor's services have been so terminated by the Owner, the termination will not affect any rights or remedies of the Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by the Owner will not release Contractor from liability.

Upon seven (7) days' written notice to Contractor and Owner's Representative, the Owner may, without cause and without prejudice to any other right or remedy of the Owner, elect to terminate the Agreement. In such case, Contractor shall be paid (without duplication of any items):

- for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
- for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
- for all claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and others;
- and for reasonable expenses directly attributable to termination.

Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.3. CONTRACTOR MAY STOP WORK OR TERMINATE

If, through no act or fault of Contractor, the Work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Owner's Representative fails to act on any Application for Payment within thirty (30) days after it is submitted or the Owner fails for thirty (30) days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven (7) days' written notice to the Owner and Owner's Representative, and provided the Owner or Owner's Representative does not remedy such suspension or failure within that time, terminate the Agreement and recover from the Owner payment on the same terms as provided in the article for the Owner May Terminate. However, if the Work is suspended under an order of court through no fault of Owner, the Contractor shall not be entitled to payment except as the Court may direct. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if Owner's Representative has failed to act on an Application for Payment within thirty (30) days after it is submitted, or the Owner has failed for thirty (30) days to pay Contractor any sum finally determined to be due, Contractor may upon seven (7) days' written notice to the Owner and Owner's Representative stop the Work until payment of all such amounts due Contractor. The provisions of this article are not intended to preclude Contractor from making claim under paragraphs for Change of Contract Price or Change of Contract Time or otherwise for expenses or damage directly attributable to Contractor's stopping Work as permitted by this article.

16. DISPUTE RESOLUTION

If and to the extent that the Owner and Contractor have agreed on the method and procedure for resolving disputes between them that may arise under this Agreement, such dispute resolution method and procedure will proceed. If no such agreement on the method and procedure for resolving such disputes has been reached, subject to the provisions of the article for Decisions on Disputes, the Owner and Contractor may exercise such rights or remedies as either may otherwise

have under the Contract Documents or by Laws or Regulations in respect of any dispute provided, however, that nothing herein shall require a dispute to be submitted to binding arbitration.

17. MISCELLANEOUS

17.1. SUBMITTAL AND DOCUMENT FORMS

The form of all submittals, notices, change orders, pay applications, logs, schedules and other documents permitted or required to be used or transmitted under the Contract Documents shall be determined by the Owner's Representative subject to the approval of Owner.

17.2. GIVING NOTICE

Whenever any provision of the Contract Documents requires the giving of written notice, notice will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.3. NOTICE OF CLAIM

Should the Owner or Contractor suffer injury or damage to person or property because of any error, omission or any act of the other party or of any of the other party's officers, employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

17.4. PROFESSIONAL FEES AND COURT COSTS INCLUDED

Whenever reference is made to "claims, costs, losses and damages," the phrase shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or other dispute resolution costs.

17.5. ASSIGNMENT OF CONTRACT

The Contractor shall not assign this contract or any part thereof or any rights thereunder without the approval of Owner, nor without the consent of surety unless the surety has waived its rights to notice of assignment.

17.6. RENEWAL OPTION

Annual Contracts issued through the Engineering Department may be renewed for up to three (3) years, upon mutual consent of both the Owner and the Contractor/Vendor. All terms, conditions and unit prices shall remain constant unless otherwise specified in the contract specifications or in the Invitation to bid. Renewals shall be made at the sole discretion of the Owner and must be agreed to in writing by both parties. All renewals are contingent upon the availability of funds, and the satisfactory performance of the Contractor as determined by the Construction Department.

17.7. ROLL-OFF CONTAINERS AND/OR DUMPSTERS

All City construction projects shall utilize City of Clearwater Solid Waste roll-off containers and/or dumpsters for their disposal and hauling needs. For availability or pricing contact City of Clearwater, Solid Waste Department, by phone: (727) 562-4929.

18. ORDER AND LOCATION OF THE WORK

The City reserves the right to accept and use any portion of the work whenever it is considered to the public interest to do so. The Engineer shall have the power to direct on what line or street the Contractor shall work and order thereof.

19. MATERIAL USED

All material incorporated into the final work shall be new material unless otherwise approved by the Engineer. If requested by the Engineer, the Contractor shall furnish purchase receipts of all materials.

20. CONFLICT BETWEEN PLANS AND SPECIFICATIONS

The various Contract Documents shall be given precedence, in case of conflict, error or discrepancy, as follows: Modifications, Contract Agreement, Addenda, Supplementary General Conditions, General Conditions, Supplementary Technical Specifications and Technical Specifications. In a series of Modifications or Addenda the latest will govern. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality, more stringent or greater quantity of Work shall be provided in accordance with the Engineer/Architect's interpretation.

21. OWNER DIRECT PURCHASE (ODP)

21.1. SALES TAX SAVINGS

The Owner reserves the right to purchase certain portions of the materials or equipment for the Project directly in order to save applicable sales tax in compliance with Florida Law since owner is exempt from the payment of sales tax. The contract price includes Florida sales and other applicable taxes for materials, supplies, and equipment which will be a part of the Contractor's Work. Owner-purchasing of construction materials or equipment, if selected, will be administered on a deductive Change Order basis. The contract price shall be reduced by the actual cost of the materials or equipment purchased by owner plus the normally applicable sales tax, even if the actual cost is in excess of the cost for the materials or equipment as-bid by the Contractor. For purposes of calculating Engineering Fees, Contractor Fees, Architects' Fees, and any other amounts that are based on the contract amount, however, the original, as-bid contract amount shall be used.

Direct purchase shall be considered for single items or materials that exceed $10,000 in value and/or items identified in Section V, Bidders Proposal. The Contractor shall provide the Owner an ODP Summary of all intended suppliers, vendors, equipment, and materials for consideration as ODP materials or equipment (refer to ODP Instructions in Contract Appendix).

21.2. TITLE AND OWNER RISK

Owner will issue Purchase Orders and provide a copy of Owner's Florida Consumer Certification of Tax Exemption and Certificate of Entitlement directly to the Vendor for ODP materials or equipment. Invoices for ODP materials or equipment shall be issued to the Owner, and a copy sent to the Contractor.

Notwithstanding the transfer of ODP materials or equipment by the Owner to the Contractor's possession, the Owner shall retain legal and equitable title to any and all ODP materials or equipment; therefore, the owner assumes the risk of damage or loss at the time of purchase or delivery of items, unless material is damaged as the result of negligence by the Contractor.

21.3. CONTRACTOR'S RECEIPT OF MATERIALS

The Contractor shall be fully responsible for all matters relating to the receipt of materials or equipment furnished to the Owner including, but not limited to, verifying correct quantities, verifying documents of orders in a timely manner, coordinating purchases, providing and obtaining all warranties and guarantees required by the Contract Documents, and inspection and acceptance of the goods at the time of delivery. The Owner shall coordinate with Contractor and Vendor delivery schedules, sequence of delivery, loading orientation, and other arrangements normally required by the Contractor for the particular materials or equipment furnished. The Contractor shall provide all services required for the unloading and handling of materials or equipment. The Contractor agrees to indemnify and hold harmless the Owner from any and all claims of whatever nature resulting from non-payment of goods to suppliers arising from the action of the Contractor.

As ODP materials or equipment are delivered to the job site, the Contractor shall visually inspect all shipments from the suppliers and approve the vendor's invoice for items delivered. The Contractor shall assure that each delivery of ODP materials or equipment is accompanied by documentation adequate to identify the Purchase Order against which the purchase is made. This documentation may consist of a delivery ticket and/or an invoice from the supplier conforming to the Purchase Order together with such additional information as the Owner may require. The Contractor will then forward an electronic copy of the invoice and supporting documentation to the Owner for payment within fourteen (14) calendar days of receipt of said goods or materials. Such payment shall be directly from public funds, from Owner to Vendor.

The Contractor shall insure that ODP materials or equipment conform to the Specifications and determine prior to acceptance of goods at time of delivery if such materials or equipment are patently defective, and whether such materials or equipment are identical to the materials or equipment ordered and match the description on the bill of lading. If the Contractor discovers defective or non-conformities in ODP materials or equipment upon such visual inspection, the Contractor shall not utilize such nonconforming or defective materials or equipment in the Contractor's Work and instead shall properly notify the Owner of the defective or nonconforming condition so that repair or replacement of those materials or equipment can occur without undue delay or interruption to the Project. If the Contractor fails to perform such inspection and otherwise incorporates into the Contractor's Work such defective or nonconforming ODP materials or equipment, the condition of which it either knew or should have known by performance of an inspection, Contractor shall be responsible for all damages to the Owner, resulting from Contractor's incorporation of such materials or equipment into the Project, including liquidated damages.

21.4. ODP RECORDS, WARRANTIES, AND INDEMNIFICATION

The Contractor shall maintain records of all ODP materials or equipment it incorporates into Contractor's Work from the stock of ODP materials or equipment in its possession. The Contractor shall account monthly to the Owner for any ODP materials or equipment delivered into the Contractor's possession, indicating portions of all such materials or equipment which have been incorporated in the Contractor's Work.

The Contractor shall be responsible for obtaining and managing all warranties and guarantees for all materials, equipment and products as required by the Contract Documents. All repair, maintenance, or damage-repair calls shall be forwarded to the Contractor for resolution with the appropriate supplier, vendor, or Subcontractor.

The Owner shall indemnify and hold Contractor harmless from any sales tax (and interest and penalties incurred in connection therewith) in the event there is a final determination that purchases made by Owner, which Owner treats as being exempt from sales tax, are subject to sales tax. "Final determination" shall mean an assessment by the Department of Revenue that is no longer subject to protest, or a determination of a court having jurisdiction over such matters that is final and not subject to appeal. Contractor agrees to promptly notify owner of any audit, assessment, proposed assessment or notice of deficiency issued with regard to the Project and relating to ODP materials or equipment. ODP Purchase Orders must be closed out prior to closing out the contract/Contractor Purchase Order. If material costs needed for project exceed the ODP Purchase Order amount, the ODP Purchase Order will not be increased. Amounts in excess of the ODP Purchase Order will be paid for by the Contractor.

22. RESIDENT NOTIFICATION OF START OF CONSTRUCTION

22.1. GENERAL

The Contractor shall notify all residents along the construction route or within a 500-foot radius, unless stated otherwise in the Contract Documents, with a printed door hanger notice indicating the following information about the proposed construction work and the Contractor performing the work: City seal or logo; the scheduled date for the start of construction; the type of construction; general sequence and scheduling of construction events; possibility of water service disruption and/or colored water due to construction efforts; Contractor’s name, the Superintendent’s name, Contractor address and telephone number; Contractor’s company logo (optional); requirement for residents to remove landscaping and/or other private appurtenances which are in conflict with the proposed construction; and other language as appropriate to the scope of Contract work. Sample door hanger including proposed language shall be approved by the City prior to the start of construction. Notification shall be printed on brightly colored and durable card stock and shall be a minimum of 4-¼ by 11 inches in size. Notification (door hanger) shall be posted to residences and businesses directly affected by the Contractor’s activities no later than seven (7) days prior to the start of construction activity. Directly affected by the Contractor’s activities shall mean all Contractor operations including staging areas, equipment and material storage, principal access routes across private property, etc. Contractor cannot start without proper seven (7) day notice period to residents. Contractor is required to maintain sufficient staff to answer citizen inquiries during normal business hours and to maintain appropriate message recording equipment to receive citizen inquires after business hours.

Resident notification by the Contractor is a non-specific pay item to be included in the bid items provided in the contract proposal.

22.2. EXAMPLE

CLEARWATER
BRIGHT AND BEAUTIFUL · BAY TO BEACH

NOTICE OF CONSTRUCTION

TODAY'S DATE: ____/____/____

PLEASE EXCUSE US FOR ANY INCONVENIENCE

We are the construction contractor performing the *(state project name)* for the City of Clearwater in your area. The work will be performed in the public right-of-way adjacent to your property. This notice is placed a minimum of seven (7) days in advance of construction to notify property owners of the pending start of construction.

(Brief description of the construction process to be expected by the property owners)

The construction process may necessitate the removal of certain items from the right-of-way. Typical items such as sprinklers, grass, and postal approved mailboxes will be replaced by the contractor within a reasonably short period of time. The replacement of driveways and sidewalks will be made using standard asphalt or concrete materials. The property owner is responsible for the expense and coordination to replace driveways and sidewalks which have customized colors, textures and/or materials. Small trees, shrubs, landscaping materials, unauthorized mailboxes or structures within the right-of-way which must be removed due to the construction process will not be replaced. The property owner is responsible to relocate any such items which the property owner wishes to save prior to the start of construction. Vehicles parked on the streets or within the right-of-way may be required to be placed elsewhere.

We are available to answer any questions you may have regarding the construction process or any particular item that must be relocated. Please contact our Construction Manager _____ at (727) _____. We will be more than happy to assist you.

Construction is anticipated to begin on: _____.

Company Name
Company Address
Contractor Phone Number

23. PROJECT INFORMATION SIGNS

23.1. SCOPE AND PURPOSE

The Owner desires to inform the general public on the Owner's use and expenditure of public funding for general capital improvement and maintenance projects. To help accomplish this purpose, the Contractor is required to prepare and display public project information signs during the full course of the contract period. These signs will be displayed at all location(s) of active work. Payment to Contractor for the preparation, installation and management of project sign(s) shall be

included in the cost of the work. The number of and type of signs will be stated in SECTION IV, SCOPE OF WORK.

23.2. PROJECT SIGN, FIXED OR PORTABLE

Sign type shall be "fixed" on stationary projects and "portable" on projects which have extended locations or various locations. The particular wording to be used on the signs will be determined after contract award has been approved. Contractor will be provided the wording to be used on sign at the preconstruction conference.

23.3. FIXED SIGN

Fixed sign shall be 4-foot by 6-foot (4'x6') in size. Sign material shall be Aluminum DIBOND or exterior grade plywood with a minimum thickness of 1/2-inches painted white on both sides with exterior rated paint. Sign shall be attached to a minimum of two (2) 4-inch by 4-inch (3½"x3½") below grade pressure treated (P.T.) wooden posts and braced as necessary for high winds. Posts shall be long enough to provide secure anchoring in the ground. Bottom of sign must be a minimum of 24-inches above the ground. Alternate mounting system or attachment to fencing or other fixed structure can be considered for approval.

23.4. PORTABLE SIGNS

Portable sign shall be a minimum of 24-inches by 30-inches (24"x30") in size and will be attached to a standard sized portable traffic barricade. Sign material shall be aluminum, 0.080-inches or thicker, background of white reflective sheeting, and shall be silkscreen or vinyl lettering. Portable sign shall be two signs located and attached to each side of the traffic barricade.

23.5. SIGN COLORING

Background shall be white. Project Descriptive Name shall be in blue lettering. All other lettering shall be black. Basic lettering on sign shall be in all capital letters, of size proportional to the sign itself. Each sign shall depict the City's logo. The Project Manager/City Representative shall provide the appropriate electronic logo file(s) to the Contractor.

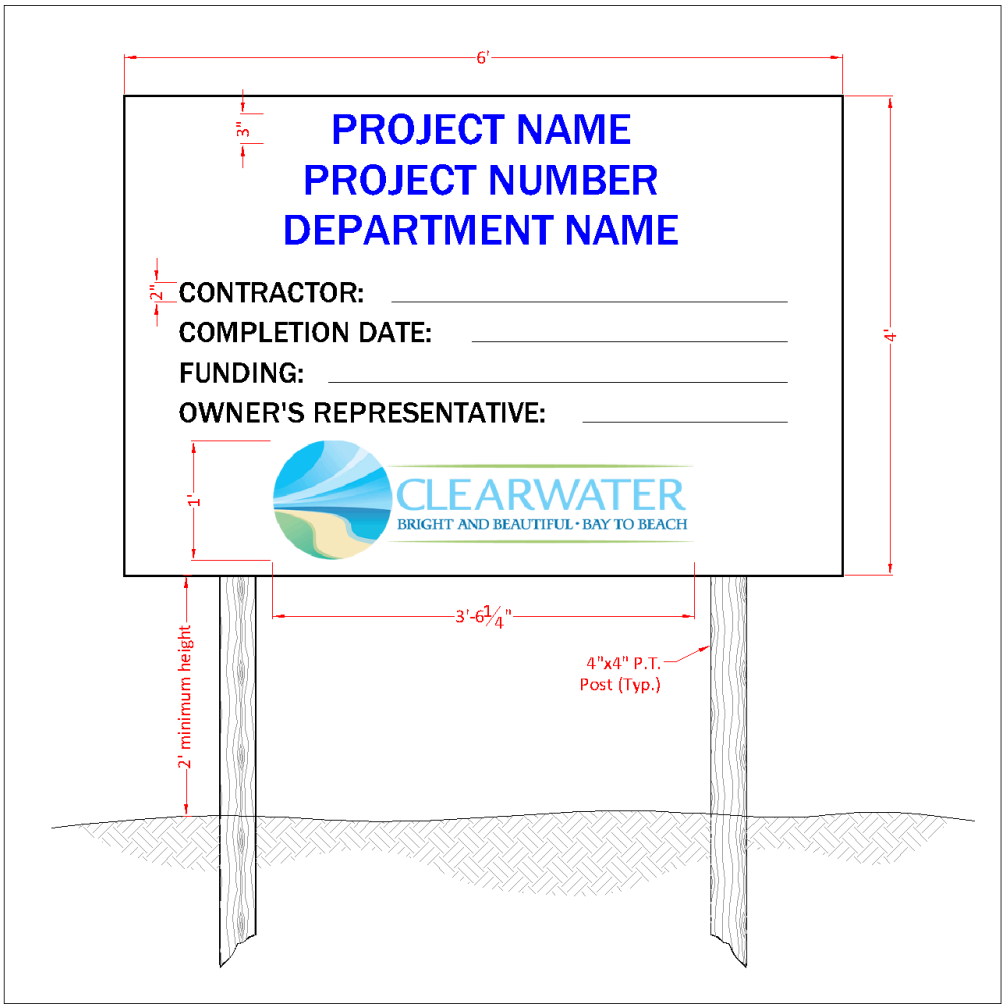
23.6. SIGN PLACEMENT

Signs shall be placed where they are readily visible by the general public which pass by the project site. Signs are not to be placed where they may become a hazard or impediment to either pedestrian or vehicular traffic. For construction projects outside of the Owner's right-of-way, the signs will be placed on the project site. For projects constructed inside of the Owner's right-of-way, the signs will be placed in the right-of-way. Portable signs are to be moved to the locations of active work on the project. Multiple portable signs will be necessary where work is ongoing in several locations at the same time. Fixed signs are to be placed at the start of construction and will remain in place until the request for final payment.

23.7. SIGN MAINTENANCE

The Contractor is responsible for preparation, installation, movement, maintenance, replacement, removal, and disposal of all project signs during the full course of the contract period. The Contractor will place and secure portable signs from dislocation by wind or other actions. Signs are to be cleaned as necessary to maintain legibility and immediately replaced if defaced.

23.8. TYPICAL PROJECT SIGN



Project Sign Details:

Font Type: Franklin Gothic Medium, (ALL CAPS)
Font Colors: Blue - Pantone 3015 and Black.

24. AWARD OF CONTRACT, WORK SCHEDULE AND GUARANTEE

It will be required that the work will commence not later than five (5) calendar days after the Engineer gives written Notice to Proceed (NTP), which notice shall be given as outlined in Article 2 of these General Conditions.

It is further required that all work within this contract be completed within the indicated number of consecutive calendar days as determined in Section IV, Scope of Work. Contract Time to commence at start date noted on the Notice to Proceed. If the Contractor fails to complete the work within the stipulated time, the City will retain the amount stated in the Contract, per calendar day, for each day that the contract remains incomplete. The work shall be discontinued on Saturdays, Sundays, and approved Holidays. If it becomes necessary for the Contractor to perform work on Saturdays, Sundays, and approved City of Clearwater Employee Holidays, that in the opinion of the Engineer, will require the presence of Inspectors, the Contractor shall pay the City of

Clearwater, Florida, the amount of Four Hundred Eighty Dollars ($480.00) per each eight-hour (8) day for each Inspector given such assignment.

The Contractor shall remedy any defects in the work at his own expense and pay for any damage to other work resulting therefrom which appear within a period of one (1) year from the date of final acceptance.

25. SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH CUBA AND SYRIA CERTIFICATION FORM AND ISRAEL CERTIFICATION FORM

Pursuant to Section 287.135, Florida Statutes, any vendor, company, individual, principal, subsidiary, affiliate, or owner on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or is engaged in business operations in Cuba or Syria, is ineligible for, and may not bid on, submit a proposal for, or enter into or renew a contract with the City of Clearwater for goods or services for an amount equal to or greater than one million ($1,000,000.00) dollars. Any vendor, company, individual, principal, subsidiary, affiliate, or owner on the Scrutinized Companies that Boycott Israel List, or is engaged in a boycott of Israel, is ineligible for, and may not bid on, submit a proposal for, or enter into or renew a contract with the City of Clearwater for goods or services for ANY amount.

Each entity submitting a bid, proposal, or response to a solicitation must certify to the City of Clearwater that it is not on the aforementioned lists, or engaged in business operations in Cuba or Syria, or engaged in a boycott of Israel at the time of submitting a bid, proposal or response, in accordance with Section 287.135, Florida Statutes. Business Operations means, for purposes specifically related to Cuba or Syria, engaging in commerce in any form in Cuba or Syria, including, but not limited to, acquiring, developing, maintaining, owning, selling, possessing, leasing or operating equipment, facilities, personnel, products, services, personal property, real property, military equipment, or any other apparatus of business or commerce. Boycott Israel or boycott of Israel means refusing to deal, terminating business activities, or taking other actions to limit commercial relations with Israel, or persons or entities doing business in Israel or in Israeli-controlled territories, in a discriminatory manner. A statement by a company that it is participating in a boycott of Israel, or that it has initiated a boycott in response to a request for a boycott of Israel or in compliance with, or in furtherance of, calls for a boycott of Israel, may be considered as evidence that a company is participating in a boycott of Israel.

The certification forms (the Certification) are attached hereto, and must be submitted, along with all other relevant contract documents, at the time of submitting a bid, proposal, or response. Failure to provide the Certification may deem the entity's submittal non-responsive. If the City of Clearwater determines that an entity has submitted a false certification form, been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List, or engaged in business operations in Cuba or Syria, or engaged in a boycott of Israel, then the contract may be terminated at the option of the City of Clearwater. Other than the submission of a false certification, the City of Clearwater, on a case-by-case basis and in its sole discretion, may allow a company to bid on, submit a proposal for, or enter into or renew a contract for goods or services, if the conditions set forth in Section 287.135, Florida Statutes, apply.

The City retains the right to pursue civil penalties and any other applicable rights and remedies as provided by law for the false submission of the attached certification forms.

See Section V of the Contract for Certification Forms to be executed and submitted with the Bid/Proposal Form.

SECTION IV

TECHNICAL SPECIFICATIONS

Table of Content:

100 SERIES: GENERAL 1

101. SCOPE OF WORK 1

102. FIELD ENGINEERING 1

102-1. LINE AND GRADE PERFORMED BY THE CONTRACTOR 1

102-2. LINE AND GRADE PERFORMED BY THE CITY 2

103. DEFINITION OF TERMS 2

103-1. REFERENCE STANDARDS 2

104. STREET CROSSINGS, ETC. 3

105. AUDIO/VIDEO RECORDING OF WORK AREAS 3

105-1. CONTRACTOR TO PREPARE AUDIO/VIDEO RECORDING 3

105-2. SCHEDULING OF AUDIO/VIDEO RECORDING 3

105-3. PROFESSIONAL VIDEOGRAPHERS 3

105-4. EQUIPMENT 3

105-5. RECORDED AUDIO INFORMATION 3

105-6. RECORDED VIDEO INFORMATION 3

105-7. VIEWER ORIENTATION 4

105-8. LIGHTING 4

105-9. SPEED OF TRAVEL 4

105-10. VIDEO LOG/INDEX 4

105-11. AREA OF COVERAGE 4

105-12. COSTS OF VIDEO SERVICES 4

106. STREET SIGNS 5

107. WORK ZONE TRAFFIC CONTROL 5

107-1. CONTRACTOR RESPONSIBLE FOR WORK ZONE TRAFFIC CONTROL 5

107-2. WORK ZONE TRAFFIC CONTROL PLAN 5

107-3. ROADWAY CLOSURE GUIDELINES 6

107-4. APPROVAL OF WORK ZONE TRAFFIC CONTROL PLAN 7

107-5. INSPECTION OF WORK ZONE TRAFFIC CONTROL OPERATION 7

107-6. PAYMENT FOR WORK ZONE TRAFFIC CONTROL 7

107-7. CERTIFICATION OF WORK ZONE TRAFFIC CONTROL SUPERVISOR 7

108. OVERHEAD ELECTRIC LINE CLEARANCE 8

108-1. CLEARANCE OPTIONS 8

108-2. REQUIRED MINIMUM CLEARANCE DISTANCES 8

200 SERIES: SITEWORK 9

201. EXCAVATION FOR UNDERGROUND INFRASTRUCTURE WORK 9

201-1. EXCAVATION, BACKFILLING, AND COMPACTION FOR UNDERGROUND INFRASTRUCTURE 10

202. OBSTRUCTIONS 21

203. DEWATERING 22
203-1. GENERAL 22
203-2. OBSERVATION WELLS 23
203-3. PUMPING AND DRAINAGE - GENERAL 23
203-4. PERMIT REQUIREMENTS 27
204. UNSUITABLE MATERIAL REMOVAL 28
204-1. BASIS OF MEASUREMENT 28
204-2. BASIS OF PAYMENT 28
205. UTILITY TIE IN LOCATION MARKING 28
206. CLEARING AND GRUBBING 28
206-1. BASIS OF MEASUREMENT 29
206-2. BASIS OF PAYMENT 29
207. EROSION AND SEDIMENT CONTROL 29
207-1. GENERAL 29
207-2. TRAINING OF PERSONNEL 29
207-3. STABILIZATION OF DENUDED AREAS 29
207-4. PROTECTION AND STABILIZATION OF SOIL STOCKPILES 30
207-5. PROTECTION OF EXISTING STORM SEWER SYSTEMS 30
207-6. SWALES, DITCHES AND CHANNELS 30
207-7. UNDERGROUND UTILITY CONSTRUCTION 30
207-8. MAINTENANCE 30
207-9. COMPLIANCE 30
208. CONSTRUCTION AND REPAIR OF SEAWALLS AND OTHER BEACH EROSION CONTROL STRUCTURES 31
208-1. EXISTING SEAWALLS AND REVETMENTS 31
208-2. TOP OF CAP ELEVATION 31
208-3. SEAWALLS AND REVETMENTS LOCATED SEAWARD OF THE CCL 31
208-4. PLACEMENT OF NEW SEAWALL 31
208-5. POST CONSTRUCTION SURVEY 32
208-6. RIP-RAP 32
208-7. RETAINING WALL IN LIEU OF VERTICAL SEAWALL 32
209. MAINTENANCE OF OPERATIONS 32
209-1. GENERAL 32
209-2. EXECUTION 32
209-3. BASIS OF MEASUREMENT 34
210. DETECTION OF FACILITIES 34
211. RELOCATIONS 35
211-1. RELOCATION SHOWN ON DRAWINGS 35
211-2. RELOCATIONS NOT SHOWN ON DRAWINGS 35
212. RESTORATION PROCEDURES 35
212-1. INTERIM RESTORATION 35
212-2. FINAL RESTORATION 35
300 SERIES: MATERIALS 37
301. CONCRETE 37
302. EXCAVATION AND FORMS FOR CONCRETE WORK 37

302-1. EXCAVATION 37
302-2. FORMS 37
303. REINFORCEMENT 37
303-1. BASIS OF PAYMENT 38
304. BACKFILL 38
304-1. MATERIALS AND GENERAL 38
304-2. TESTING AND INSPECTION 38
305. RIPRAP 39
305-1. BASIS OF MEASUREMENT 39
305-2. BASIS OF PAYMENT 39
306. FLOWABLE FILL 40
307. MATERIAL INDEPENDENT TESTING 41
400 SERIES: SANITARY SEWER 42
401. SANITARY MANHOLES 42
401-1. BUILT UP TYPE 42
401-2. PRECAST TYPE 43
401-3. DROP MANHOLES 45
401-4. FRAMES AND COVERS 45
401-5. MANHOLE COATINGS 45
401-6. CONNECTIONS TO MANHOLES 45
401-7. MEASUREMENT AND PAYMENT 45
402. RAISING OR LOWERING OF SANITARY SEWER STRUCTURES 45
402-1. BASIS OF PAYMENT 45
403. SANITARY SEWERS AND FORCE MAINS 45
403-1. MATERIALS 45
403-2. INSTALLATION 46
403-3. INSPECTIONS OF LINES AND MANHOLES 46
403-4. TESTING 48
403-5. BASIS OF PAYMENT 48
404. CURED-IN-PLACE PIPE SANITARY SEWER REHABILITATION 49
404-1. GENERAL 49
404-2. MEASUREMENT & PAYMENT 50
404-3. SUBMITTALS 50
404-4. CURED-IN-PLACE PIPE (CIPP) FOR GRAVITY SEWER MAINS 51
404-5. CURED-IN-PLACE PIPE (CIPP) FOR SERVICE LATERALS 54
405. SANITARY MANHOLE LINER RESTORATION 58
405-1. SCOPE AND INTENT 58
405-2. MEASUREMENT & PAYMENT 59
405-3. CEMENTITIOUS COATING SYSTEM 60
405-4. RAVEN 405 EPOXY COATING SYSTEM 64
405-5. SPRAYWALL POLYURETHANE COATING SYSTEM 68
405-6. INTERNAL MANHOLE CORBEL SEALING SYSTEM 72
406. SMOKE AND DYE TESTING 75
406-1. GENERAL PROTOCOL 75
406-2. REPORTING 75

406-3. DYE INVESTIGATION 77
406-4. MEASUREMENT AND PAYMENT 79
406-5. BASIS OF PAYMENT 79

500 SERIES: POTABLE AND RECLAIMED WATER MAINS, FIRE LINES AND APPURTENANCES 80

501. SCOPE 80
502. MATERIALS 80
502-1. GENERAL 80
502-2. PIPE MATERIALS AND FITTINGS 80
502-3. GATE VALVES 92
502-4. VALVE BOXES 93
502-5. HYDRANTS 94
502-6. SERVICE SADDLES/ POLYETHYLENE SERVICE LINES 95
502-7. BACKFLOW PREVENTERS 96
502-8. TAPPING SLEEVES AND LINESTOPS 96
502-9. LINE STOPPING ASSEMBLIES 98
502-10. BLOW OFF HYDRANTS 99
503. CONSTRUCTION 99
503-1. MATERIAL HANDLING 99
503-2. PIPE LAYING 100
503-3. SETTING OF VALVES, HYDRANTS AND FITTINGS 118
503-4. CONNECTIONS TO EXISTING POTABLE WATER OR RECLAIMED WATER LINES 121
504. PIPELINE CLEANING 122
504-1. PIPELINE PIGGING 122
504-2. FINAL PIPELINE FLUSHING 123
505. TESTS 123
505-1. HYDROSTATIC PIPELINE TESTING 123
505-2. NOTICE OF TEST 124
506. DISINFECTION AND TESTING 124
506-1. DISINFECTION MATERIALS 124
506-2. FLUSHING SYSTEM 125
506-3. FINAL DISINFECTION PROCEDURE FOR POTABLE WATER MAINS 125
506-4. FLUSHING AND RESIDUAL CHLORINE TESTS 127
506-5. BACTERIALOGICAL TESTS 127
507. CORRECTION OF NON-CONFORMING WORK 128
508. OBTAINING WATER FOR FLUSHING AND TESTING 128
509. MEASUREMENT AND PAYMENT 128
509-1. GENERAL 128
509-2. FURNISH AND INSTALL WATER MAINS 129
509-3. FURNISH AND INSTALL FITTINGS 129
509-4. FURNISH AND INSTALL GATE VALVES COMPLETE WITH BOXES AND COVERS 129
509-5. FURNISH AND INSTALL FIRE HYDRANTS 129

600 SERIES: STORMWATER 131

601. RAISING OR LOWERING OF STORM DRAINAGE STRUCTURES..... 131
601-1. BASIS OF PAYMENT 131
602. UNDERDRAINS..... 131
602-1. BASIS OF MEASUREMENT 131
602-2. BASIS OF PAYMENT 131
603. STORM SEWERS..... 132
603-1. TESTING AND INSPECTION 132
603-2. BASIS OF PAYMENT 132
604. STORM MANHOLES, INLETS, CATCH BASINS OR OTHER STORM STRUCTURES..... 133
604-1. BUILT UP TYPE STRUCTURES..... 133
604-2. PRECAST TYPE 133
604-3. BASIS OF PAYMENT 134
605. GABIONS AND MATTRESSES..... 134
605-1. MATERIAL 134
605-2. PERFORMANCE 135
700 SERIES: STREETS AND SIDEWALKS 136
701. RESTORATION OR REPLACEMENT OF DRIVEWAYS, CURBS, SIDEWALKS AND STREET PAVEMENT 136
702. ROADWAY BASE AND SUBGRADE..... 136
702-1. BASE..... 136
702-2. SUBGRADE 138
703. ASPHALTIC CONCRETE MATERIALS..... 138
703-1. ASPHALTIC CONCRETE..... 138
703-2. HOT BITUMINOUS MIXTURES – PLANT, METHODS, EQUIPMENT & QUALITY ASSURANCE 139
703-3. ASPHALT MIX DESIGNS AND TYPES..... 139
703-4. ASPHALT PAVEMENT DESIGNS AND LAYER THICKNESS..... 139
703-5. GENERAL CONSTRUCTION REQUIREMENTS..... 139
703-6. CRACKS AND POTHOLE PREPARATION..... 140
703-7. ADJUSTMENT OF MANHOLES AND APPURTANENCES 140
703-8. ADDITIONAL ASPHALT REQUIREMENTS 141
703-9. BASIS OF MEASUREMENT 141
703-10. BASIS OF PAYMENT 141
704. ADJUSTMENT TO THE UNIT BID PRICE FOR ASPHALT 142
705. ASPHALT DRIVEWAYS 142
705-1. BASIS OF MEASUREMENT 142
705-2. BASIS OF PAYMENT 142
706. CONCRETE CURBS..... 142
706-1. BASIS OF MEASUREMENT 143
706-2. BASIS OF PAYMENT 143
707. CONCRETE SIDEWALKS AND DRIVEWAYS..... 143
707-1. CONCRETE SIDEWALKS..... 143
707-2. CONCRETE DRIVEWAYS..... 143
707-3. CONCRETE CURB RAMPS 144

707-4. BASIS OF MEASUREMENT 144
707-5. BASIS OF PAYMENT 144
708. MILLING OPERATIONS 144
708-1. EQUIPMENT, CONSTRUCTION & MILLED SURFACE 144
708-2. ADDITIONAL MILLING REQUIREMENTS 144
708-3. SALVAGEABLE MATERIALS 145
708-4. DISPOSABLE MATERIALS 145
708-5. ADJUSTMENT AND LOCATION OF UNDERGROUND UTILITIES 145
708-6. ADJUSTMENT OF UTILITY MANHOLES 145
708-7. TYPES OF MILLING 145
708-8. MILLING OF INTERSECTIONS 146
708-9. BASIS OF MEASUREMENT 146
708-10. BASIS OF PAYMENT 146
800 SERIES: TRAFFIC SIGNALS, SIGNS AND MARKINGS 147
801. TRAFFIC SIGNAL EQUIPMENT AND MATERIALS 147
801-1. BASIS OF MEASUREMENT AND PAYMENT 147
802. SIGNING AND MARKING 147
802-1. BASIS OF MEASUREMENT AND PAYMENT 148
803. ROADWAY LIGHTING 148
803-1. BASIS OF MEASUREMENT AND PAYMENT 148
900 SERIES: LANDSCAPING/RESTORATION 149
901. WORK IN EASEMENTS OR PARKWAYS 149
902. GENERAL PLANTING SPECIFICATIONS 149
902-1. IRRIGATION 149
902-2. LANDSCAPE 155
903. SODDING 165
904. SEEDING 166
905. LAWN MAINTENANCE SPECIFICATIONS 166
905-1. SCOPE 166
905-2. SCHEDULING OF WORK 166
905-3. WORK METHODS 167
906. LEVEL OF SERVICE 168
907. COMPLETION OF WORK 169
908. INSPECTION AND APPROVAL 169
909. SPECIAL CONDITIONS 169
910. TREE PROTECTION 169
910-1. TREE BARRICADES 169
910-2. ROOT PRUNING 170
910-3. PROPER TREE PRUNING 171
911. IRRIGATION SYSTEM DESIGN 171
912. IRRIGATION SYSTEM INSTALLATION 172

100 SERIES: GENERAL

101. SCOPE OF WORK

Project Name: East Water Reclamation Facility Screw Pump

Project Number: 22-0028-UT

Scope of Work: Replace three existing open screw pumps, grease pumps, motors, and appurtenances as required by the Contract Documents. Refurbish the existing three slide gates located adjacent to the existing screw pumps as required by the Contract Documents. Modify the existing electrical system including new electrical conduit, wire, starter panels; modify the existing motor control center; reconnect proposed signal wiring to the existing control panel and supervisory control and data acquisition (SCADA) system to match the existing; and other improvements to the screw pumps as required by the Contract Documents. Provide coating systems as indicated in the Contract Documents and expansion joint and crack injection repair on the screw pump concrete structure. Any other items indicated within the Contract Documents.

The Contractor shall provide copies of a current Contractor License/Registration with the state of Florida and Pinellas County in the bid response.

The Contractor shall provide one (1) fixed project sign as described in Section III, Section 23 of the Contract Documents. The final number of project signs will be determined at the beginning of the project based on the Contractor's schedule of work submitted for approval. Additional project signs may be required at no additional cost to the city due to the Contractor's schedule of work.

Contract Period: 390 Calendar Days

102. FIELD ENGINEERING

102-1. LINE AND GRADE PERFORMED BY THE CONTRACTOR

Unless otherwise specified, the Contractor shall provide and pay for field engineering service required for the project. Such work shall include survey work to establish lines and levels and to locate and lay out site improvements, structures, and controlling lines and levels required for the construction of the work. Also included are such Engineering services as are specified or required to execute the Contractor's construction methods. Engineers and Surveyors shall be licensed professionals under the laws of the State of Florida. The Contractor shall provide three (3) complete sets of As-Built Surveys to the Engineer prior to final payment being made as outlined in Section III (General Conditions), Section 6.11.2 of these Contract Documents.

102-1.1. GRADES, LINES AND LEVELS

Existing basic horizontal and vertical control points for the project are those designated on the Drawings or provided by the city. Control points (for alignment only) shall be established by the Engineer. The Contractor shall locate and protect control points prior to starting site work and shall preserve all permanent reference points during construction. In working near any permanent property corners or reference markers, the Contractor shall use care not to remove or disturb any such markers. In the event that markers must be

removed or are disturbed due to the proximity of construction work, the Contractor shall have them referenced and reset by a Professional Land Surveyor licensed in the State of Florida.

102-1.2. LAYOUT DATA

The Contractor shall layout the work at the location and to the lines and grades shown on the Drawings. Survey notes indicating the information and measurements used in establishing locations and grades shall be kept in notebooks and furnished to the Engineer with the record drawings for the project.

102-2. LINE AND GRADE PERFORMED BY THE CITY

If line and grade is supplied by the city, at the completion of all work the Contractor shall be responsible to have furnished to the project inspector a replacement of the wooden lath and stakes used in the construction of this project. Excessive stake replacement caused by negligence of Contractor's forces, after initial line and grade have been set, as determined by the City Engineer, will be charged to the Contractor at the rate of $200.00 per hour. Time shall be computed for actual time on the project. All time shall be computed in one-hour increments. Minimum charge is $200.00. The Contractor shall provide three (3) complete sets of As-built Surveys to the Engineer prior to final payment being made as outlined in Section III (General Conditions), Section 6.11.2 of these Contract Documents.

103. DEFINITION OF TERMS

For the Purpose of these Technical Specifications, the Definition of Terms from *Section III, Article 1 – Definitions* of these Contract Documents shall apply.

For the purpose of the Estimated Quantities, the Contractor's attention is called to the fact that the estimate of quantities as shown on the Proposal is approximate and is given only as a basis of calculation upon which the award of the contract is to be made. The city does not assume any responsibility that the final quantities will remain in strict accordance with estimated quantities nor shall the Contractor plead misunderstandings or deception because of such estimate of quantities or of the character or location of the work or of other conditions or situations pertaining thereto.

The basis of payment for work and materials will be the actual amount of work done and materials furnished. Contractor agrees that they will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work performed and materials actually furnished and the estimated amounts thereof.

103-1. REFERENCE STANDARDS

Reference to the standards of any technical society, organization, or associate, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standard adopted and published at the date of receipt of bids, unless specifically stated otherwise.

The most stringent specification prevails in the case where more than one specification is referenced for the same task.

Contractor shall utilize applicable Florida Department of Transportation (FDOT) Standards and Specifications for tasks that are not covered by city’s Standards and Specifications.

104. STREET CROSSINGS, ETC.

At such crossings, and other points as may be directed by the Engineer, trenches shall be bridged in an open and secure manner, so as to prevent any serious interruption of travel upon the roadway or sidewalk, and also to afford necessary access to public or private premises. The material used, and the mode of constructing said bridges, and the approaches, thereto, must be satisfactory to the Engineer.

The cost of all such work must be included in the cost of the trench excavation.

105. AUDIO/VIDEO RECORDING OF WORK AREAS

105-1. CONTRACTOR TO PREPARE AUDIO/VIDEO RECORDING

Prior to commencing work, the Contractor shall have a continuous color audio/video recording taken along the entire length of the Project including all affected project areas. Streets, easements, rights-of-way, lots or construction sites within the Project must be recorded to serve as a record of pre-construction conditions.

105-2. SCHEDULING OF AUDIO/VIDEO RECORDING

The video recordings shall not be made more than twenty-one (21) days prior to construction in any area.

105-3. PROFESSIONAL VIDEOGRAPHERS

The Contractor shall engage the services of a professional videographer. The color audio/video recording shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of pre-construction color audio/video recording documentation. Use of drones must be in accordance with Federal Aviation Administration (FAA) regulations.

105-4. EQUIPMENT

All equipment, accessories, materials, and labor to perform this service shall be furnished by the Contractor. The total audio/video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume, clarity and be free from distortion and interruptions. In some instances, audio/video coverage may be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking.

105-5. RECORDED AUDIO INFORMATION

Each recording shall begin with the current date, project name and be followed by the general location, i.e., viewing side and direction of progress. Accompanying the video recording of each video shall be a corresponding and simultaneously recorded audio recording. This audio recording, exclusively containing the commentary of the camera operator or aide, shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the features being shown in the video portion of the recording. The audio recording shall also be free from any conversations.

105-6. RECORDED VIDEO INFORMATION

All video recordings must continuously display transparent digital information to include the date and time of recording. The date information shall contain the month, day, and year. The time information shall

contain the hour, minutes, and seconds. Additional information shall be displayed periodically. Such information shall include, but not be limited to, project name, contract number, direction of travel and the viewing side. This transparent information shall appear on the extreme upper left hand third of the screen. Camera pan, tilt, zoom-in and zoom out rates shall be sufficiently controlled such that recorded objects will be clearly viewed during video playback. In addition, all other camera and recording system controls, such as lens focus and aperture, video level, pedestal, chrome, white balance, and electrical focus shall be properly controlled or adjusted to maximize picture quality.

105-7. VIEWER ORIENTATION

The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views of all visible house and business addresses shall be utilized. In areas where the proposed construction location will not be readily apparent to the video viewer, highly visible yellow flags shall be placed by the Contractor in such a fashion as to clearly indicate the proposed centerline of construction. When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed ten feet (10’). The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.

105-8. LIGHTING

All recording shall be done during time of good visibility. No videoing shall be done during precipitation, mist, or fog. The recording shall only be done when sufficient light is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.

105-9. SPEED OF TRAVEL

The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size, and value of the surface features within the construction area’s zone of influence. The rate of speed in the general direction of travel used during videoing shall not exceed forty-four (44) feet per minute.

105-10. VIDEO LOG/INDEX

All videos shall be permanently labeled and shall be properly identified by video number and project title. Each video shall have a log of that video's contents. The log shall describe the various segments of coverage contained on the video in terms of the names of the streets or location of easements, coverage beginning and end, directions of coverage, video unit counter numbers, engineering survey or coordinate values (if reasonably available) and the date.

105-11. AREA OF COVERAGE

Video coverage shall include all surface features located within the zone of influence of construction supported by appropriate audio coverage. Such coverage shall include, but not be limited to, existing driveways, sidewalks, curbs, pavements, drainage system features, mailboxes, landscaping, culverts, fences, signs, Contractor staging areas, adjacent structures, etc., within the area covered by the project. Of particular concern shall be the existence of any faults, fractures, or defects. Taped coverage shall be limited to one side of the Site, street, easement or right of way at any one time.

105-12. COSTS OF VIDEO SERVICES

The cost to complete the requirements under this section shall be included in the contract items provided in the proposal sheet. There is no separate pay item for this work.

106. STREET SIGNS

The removal, covering or relocation of street signs by the Contractor is prohibited.

All street signs shall be removed, covered, or relocated by the city's Traffic Engineering Division in accordance with Sections 700, 994, 995, and 996 of FDOT's Standard Specifications.

The Contractor shall notify the city's Traffic Engineering Division a minimum of twenty-four (24) hours in advance of the proposed sign relocation, covering or removal.

107. WORK ZONE TRAFFIC CONTROL

107-1. CONTRACTOR RESPONSIBLE FOR WORK ZONE TRAFFIC CONTROL

The Contractor shall be responsible to furnish, operate, maintain and remove all work zone traffic control associated with the Project, including detours, advance warnings, channelization, hazard warnings and any other necessary features, both at the immediate work site and as may be necessary at outlying points.

107-2. WORK ZONE TRAFFIC CONTROL PLAN

The Contractor shall prepare a detailed traffic control plan designed to accomplish the level of performance outlined in the Scope of the Work and/or as may be required by construction permits issued by Pinellas County and/or the FDOT for the Project, incorporating the methods and criteria contained in Part VI, Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility and Incident Management Operations in the Manual on Uniform Traffic Control Devices published by the U.S. Department of Transportation and adopted as amended by the Florida Department of Transportation, or most recent addition. This plan shall be reviewed and approved by city Engineering Department Traffic Operations personnel regardless if Maintenance of Traffic (MOT) plan details are included in the contract plans.

107-2.1. WORK ZONE SAFETY

The general objectives of a program of work zone safety are to protect workers, pedestrians, bicyclists and motorists during construction and maintenance operations. This general objective may be achieved by meeting the following specific objectives:

- Provide adequate advance warning and information regarding upcoming work zones.
- Provide the driver clear directions to understanding the situation they will be facing as the driver proceeds through or around the work zone.
- Reduce the consequences of an out of control vehicle.
- Provide safe access and storage for equipment and material.
- Promote speedy completion of projects (including thorough cleanup of the site).
- Promote use of the appropriate traffic control and protection devices.
- Provide safe passageways for pedestrians through, in, and/or around construction or maintenance work zones.

"When an existing pedestrian way or bicycle way is located within a traffic control work zone, accommodation must be maintained and provision for the disabled must be provided. Only approved pedestrian longitudinal channelizing devices may be used to delineate a temporary traffic control zone pedestrian walkway. Advanced notification of sidewalk closures and marked detours shall be provided by

appropriate signs." Per the 2014 FDOT Standard Specifications for Road and Bridge Construction or latest revision.

FDOT Design Standards (DS): 102-5 Traffic Control, 102-5.1 Standards, are the minimum standards for the use in the development of all traffic control plans (use the latest edition).

All traffic control plans must be submitted to the city Engineering Department, Traffic Operations Division for review and approval prior to installation. Contractor shall also provide notification to city Engineering, Traffic Operations Division a minimum of 72-hours in advance of mobilization. Approved MOT must always be on site and accessible to the city Project Manager and/ or Representative.

107-3. ROADWAY CLOSURE GUIDELINES

Roadway types: Major Arterials, Minor Arterials, Local Collectors, and Local

Following are typical requirements to be accomplished prior to closure. The number of requirements increases with traffic volume and the importance of access. Road closures affecting business or sole access routes will increase in process requirements as appropriate. For all but local streets, no road or lane closures are allowed without prior approval by the City Engineer or designated Representative (Engineering Traffic Operations Manager).

107-3.1. ALL ROADWAYS

Obtain permits for Pinellas County or Florida Department of Transportation roadways.

Traffic control devises conform to national and state standards.

107-3.1.1. PUBLIC NOTIFICATION

Standard property owner notification prior to start of construction for properties directly affected by the construction process.

107-3.2. MAJOR ARTERIALS, MINOR ARTERIALS, LOCAL COLLECTORS

Consult with city Engineering Traffic Operations Division staff for preliminary traffic control options.

Develop Formal Traffic Control Plan for Permit Submittal to Regulatory Agency as necessary.

107-3.2.1. PUBLIC NOTIFICATION

Message Board Display, Minimum of seven (7) day notice period prior to road closure and potentially longer for larger highway. The message board is to be provided by the Contractor.

107-3.3. MAJOR ARTERIALS, MINOR ARTERIALS

107-3.3.1. PUBLIC NOTIFICATION

Releases can be issued as PowerPoint Presentation for C-View System utilizing television monitors.

107-3.4. MAJOR ARTERIALS

107-3.4.1. PUBLIC NOTIFICATION

News Releases shall be issued by the city Public Communication Department. The Message Board may need to be displayed for a period longer than seven (7) days.

107-4. APPROVAL OF WORK ZONE TRAFFIC CONTROL PLAN

The Contractor is invited and encouraged to confer in advance of bidding, and is required, as a specification of the work, to confer in advance of beginning any work on the Project, with the Traffic Operations Division, Municipal Services Building, 100 South Myrtle Avenue, telephone (727) 562-4747, for the purpose of approval of the Contractor's proposed detailed traffic control plan. All maintenance of traffic (MOT) plans shall be signed and sealed by a Professional Engineer or an individual who is certified in the preparation of MOT plans in the State of Florida. Contractor is required to submit the MOT preparer's accreditation along with the plan submittal.

107-5. INSPECTION OF WORK ZONE TRAFFIC CONTROL OPERATION

The city Engineering Traffic Operations Division may inspect and monitor the traffic control plan and traffic control devices of the Contractor. The city's Construction Inspector assigned to the project may make known requirements for any alterations or adjustments to the traffic control devices. The Contractor shall take direction from the city representative.

107-6. PAYMENT FOR WORK ZONE TRAFFIC CONTROL

Payment for work zone traffic control is a non-specific pay item to be included in the construction costs associated with other specific pay items unless specifically stated otherwise.

107-7. CERTIFICATION OF WORK ZONE TRAFFIC CONTROL SUPERVISOR

The city may require that the Supervisor or Foreman controlling the work for the Contractor on the Project have a current International Municipal Signal Association, Work Zone Traffic Control Safety Certification or Worksite Traffic Supervisor Certification from the American Traffic Safety Association with additional current Certification from the Florida Department of Transportation. This requirement for Certification will be noted in the Scope of Work and/or sections of these Technical Specifications. When the certified supervisor is required for the Project, the supervisor will be on the Project site at all times while work is being conducted.

The Worksite Traffic Supervisor shall be available on a twenty-four (24) hour per day basis and shall review the project on a day-to-day basis as well as being involved in all changes to traffic control. The Worksite Traffic Supervisor shall have access to all equipment and materials needed to maintain traffic control and handle traffic related situations. The Worksite Traffic Supervisor shall ensure that routine deficiencies are corrected within a twenty-four (24) hour period.

The Worksite Traffic Supervisor shall be available on the site within 45 minutes after notification of an emergency situation, prepared to positively respond to repair the work zone traffic control or to provide alternate traffic arrangements.

Failure of the Worksite Traffic Supervisor to comply with the provisions of this sub section may be grounds for decertification or removal from the project or both. Failure to maintain a designated Worksite Traffic Supervisor or failure to comply with these provisions will result in temporary suspension of all activities except traffic and erosion control and such other activities deemed to be necessary for project maintenance and safety.

108. OVERHEAD ELECTRIC LINE CLEARANCE

108-1. CLEARANCE OPTIONS

When working in the vicinity of overhead power lines, the Contractor shall utilize one of the following options:

Option 1: Having the power lines de-energized and visibly grounded.

Option 2: Maintaining a minimum distance of twenty feet (20') of clearance for voltages up to 350 kV and fifty feet (50') of clearance for voltages more than 350 kV.

Option 3: Determine the line voltage and provide clearance in accordance with the following table.

108-2. REQUIRED MINIMUM CLEARANCE DISTANCES

VOLTAGE [nominal, kV, alternating current]	MINIMUM CLEARANCE DISTANCE [feet]
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1,000	45
Over 1,000	(as established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electric power transmission and distribution)

Note: The value that follows "to" is up to and includes that value. For example, over 50 to 200 means up to and including 200kV.

The equipment supplied and installed shall meet the requirements of the National Electric Code and all applicable local codes and regulations

200 SERIES: SITEWORK

201. EXCAVATION FOR UNDERGROUND INFRASTRUCTURE WORK

The Contractor is responsible to take all necessary steps to conduct all excavation in a manner which provides for the successful completion of the proposed work while at all times maintaining the safety of the workmen, the general public and both public and private property. The Contractor's methods of work will be consistent with the standard practices and requirements of all appropriate Safety Regulatory Agencies, particularly the Occupational Safety and Health Administration (OSHA) requirements for excavation. Unless otherwise specifically stated in these plans and specifications, the methods of safety control and compliance with regulatory agency safety requirements are the full and complete responsibility of the Contractor.

For the purposes of the Contractor's safety planning in the bidding process, the Contractor is to consider all excavation to be done in the performance of this contract to be in soil classified as OSHA "Type C". The Contractor's attention is called to specific requirements of OSHA for excavation shoring, employee entry, location of excavated material adjacent to excavation, the removal of water from the excavation, surface encumbrances and in particular the requirement of a "Competent Person" to control safety operations. The Contractor shall submit to the city if requested prior to the start of work a safety plan for the excavation and work activities. The Contractor will identify their Competent Person to city staff at the start of construction. Clearwater Fire Dept. requires a Trench Permit and site inspection for any depths greater than five feet (5') and any excavation that exceeds twenty feet (20') shall require the submittal of a trench shoring plan prepared by a Professional Engineer actively licensed in the State of Florida.

City staff is required from time to time to perform inspections, tests, survey location work, or other similar activity in an excavation prepared by the Contractor. City staff, in conformance with the OSHA Excavation Safety Requirements, is to only enter an excavation in compliance with these OSHA standards. The city's staff reserve the option to refuse entry into the Contractor's excavation if, in the opinion of the city's staff, the entry into the Contractor's excavation is unsafe or does not conform to OSHA requirements. If this circumstance occurs, the Contractor must either provide the necessary safety requirements or provide alternate means for the accomplishment of the city's work at the Contractor's expense.

The construction quantities, if any, contained in the bid proposal for this contract do not contain sufficient quantities to allow the Contractor to perform excavation work using strictly the "open cut" method whereby no shoring systems are used and trench side slopes are cut to conform to OSHA safety requirements without a shoring system. In addition to safety reasons, the Contractor is required to use excavation and trench-shoring methods in compliance with all safety requirements which allow the Contractor to control the amount of restoration work necessary to complete the project.

Not more than four hundred feet (400') of trench shall be opened at one time in advance of the completed work unless written permission is received from the city and/or the Engineer for the distance specified. For pipe installation projects, the trench shall be a minimum of six inches (6") wider on each side than the greatest external horizontal width of the pipe or conduit, including hubs, intended to be laid in them. The bottom of the trench under each pipe joint shall be slightly hollowed, to allow the body of the pipe to rest throughout its length. In case a trench is excavated at any place, except at joints, below the grade of its bottom as given, or directed by the Engineer, the filling and compaction to grade shall be done in such manner as the Engineer shall direct, without additional compensation.

201-1. EXCAVATION, BACKFILLING, AND COMPACTION FOR UNDERGROUND INFRASTRUCTURE

201-1.1. GENERAL

Scope of Work: The work included under this Section consists of dewatering, excavating, trenching, sheeting/shoring, grading, backfilling, and compacting those soil materials required for the construction of the structures, piping, ditches, utility structures and appurtenances as shown on the Drawings and specified herein.

Definitions:

A. Maximum Density: Maximum weight in pounds per cubic foot of a specific material as determined by ASTM D1557.
B. Optimum Moisture Content: The optimum moisture content shall be determined by ASTM D 1557 specified to determine the maximum dry density for relative compaction. Field moisture content shall be determined on the basis of the fraction passing the 3/4-inch sieve.
C. Rock Excavation: Excavation of any hard-natural substance which requires the use of special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
D. Suitable Soil Materials: Suitable materials for fills shall be a non-cohesive, non-plastic granular local sand and shall be free from vegetation, organic material, marl, silt or muck and shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M-145. Not more than 10 percent (%) by weight of fill material shall pass the No. 200 Sieve. The Contractor shall furnish all additional fill material required.
E. Unsuitable Soil Materials: Unsuitable materials are classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, and A-8 in accordance with AASHTO Designation M-145.

Plan for Earthwork:

A. The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract according to the General Conditions.
B. Prior to commencing the excavation, the Contractor shall submit a plan of his proposed operations, including maintenance of traffic, to the Engineer and the city for review and approval. The Contractor shall consider, and his plan for excavation shall reflect, the equipment and methods to be employed in the excavation. The prices established in the Proposal for the work to be done will reflect all costs pertaining to the work. No claims for extras based on substrata or groundwater table conditions shall be allowed.

Trench Safety:

A. All trench excavations which exceed 5 feet in depth shall comply at all times with the applicable trench safety standards as stated in the OSHA excavation safety standards 29 CFR S. 1926.650 Subpart P as regulated and administered by the Florida Department of Labor and Employment Security as the “Florida Trench Safety Act”.
B. The Contractor shall comply with all of the requirements of the Florida Trench Safety Act. The Contractor shall acknowledge that included in various items of his bid proposal and in the total bid price are costs for complying with the provisions of the Act.

Testing: A Certified Testing Laboratory employed by the Contractor shall make such tests as are required to demonstrate compliance with these specifications. The Contractor shall schedule his work to permit a

reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. All costs for all testing shall be paid by the Contractor.

Changed Job Conditions: If, in the opinion of the Engineer or the city Representative, conditions encountered during construction warrant a change in the structure footing elevation, or in the depth of removal of unsuitable material from that indicated in the soils report, an adjustment will be made in the contract price as provided in the General and Special Conditions.

Utility Construction Surveys:

A. Prior to commencing excavation, backfill or dewatering for utilities, the Contractor shall conduct a survey of those existing structures which, in the opinion of the Engineer, may be subject to settlement or distress resulting from excavation or dewatering operations.
B. The Contractor shall monitor the structures surveyed to ascertain evidence of settlement or distress during construction. If settlement or distress becomes evident, the Contractor shall be required to repair the structures to the previous condition to the satisfaction of the Engineer and the city. All costs for repairs shall be paid by the Contractor.

Submittals:

A. Submit to the Engineer for review the proposed methods of construction, including dewatering, excavation, bedding, filling, compaction, and backfilling for the various portions of the work. Review shall be for method only. The Contractor shall remain responsible for the adequacy and safety of the methods.
B. Submit to the Engineer for review and approval the sieve analyses and soil classifications completed by the Geotechnical Engineer hired by the Contractor, for materials to be used for pipe bedding and trench and structural backfill including Structural Fill, Class I and Class II soil materials, Crushed Stone bedding materials and Coarse Sand materials.
C. Submit to the Engineer for review, the soil compaction results

201-1.2. MATERIALS

General Requirements:

A. All fill materials from on and off-site sources shall be subject to the approval of the Engineer and the city.
B. All fill material shall be unfrozen and free of organic material, trash, or other objectionable material. Excess or unsuitable material as designated by the Engineer shall be removed from the job site by the Contractor.

Common Fill Materials:

A. Common fill shall be sand, free of clay, organic material, muck, loam, wood, trash and other objectionable material which may be compressible, or which cannot be compacted properly. It shall not contain stones, rock, concrete or other rubble larger than 1-1/2-inches in diameter. It shall have physical properties which allow it to be easily spread and compacted.
B. Common fill shall be no more than 10 percent by weight finer than the No. 200 mesh sieve.
C. The Contractor shall utilize as much excavated material as possible for reuse as backfill material in accordance with the Contract Drawings and Project Specifications or as directed by the Engineer.
D. The Engineer shall direct the Contractor on the type of material allowed in certain sections of the earthwork operations.

Structural Fill:

Structural fill shall be well graded sand to gravel-sand having the following gradation:

U.S. Sieve Size	Percent Passing by Weight
1-inch	100%
No. 4 Sieve	75% to 100%
No. 40 Sieve	15% to 80%
No. 100 Sieve	0 to 30%
No. 200 Sieve	0 to 10%

Class I Soils*:

Manufactured angular, granular material, 1/4-inch to 1-1/2- inches in size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

A. Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter conforming with particle size limits as included in *Table 201-A* below. Unless approved otherwise by the engineer, crushed stone for PVC, FRP or HDPE pipe bedding shall conform with ASTM C33 stone size No. 89 and crushed stone for ductile iron pipe shall conform to ASTM C33 stone size No. 68 or 78.

* Soils defined as Class I soils are not defined in ASTM D2487.

Class II Soils:**

A. GW: Well-graded gravels and gravel-sand mixtures, little or no fines, clean. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve.
B. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines, clean. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve.
C. SW: Well-graded sands and gravelly sands, little or no fines, clean. More than fifty (50) percent passing No. 4 sieve. More than 95 percent retained on No. 200 sieve.
D. SP: Poorly graded sands and gravelly sands, little or no fines, clean. More than fifty (50) percent passing No. 4 sieve. More than 95 percent retained on No. 200 sieve.

** In accordance with ASTM D2487, less than 5 percent passing No. 200 sieve.

Coarse Sand:

Sand shall consist of clean mineral aggregate with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
No. 10 Sieve	100%
No. 20 Sieve	0 to 30%
No. 40 Sieve	0 to 5%

Other Material:

All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by the Engineer.

201-1.3. cLEARING AND gRUBBING

201-1.3.1. GENERAL

A. Clearing: Clearing shall completely remove and dispose of all timber, shrubs, brush, stumps, limbs, roots, grass, weeds, other vegetative growth, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. Remove all evidence of their presence from the surface including sticks and branches. Remove and dispose of trash piles and rubbish that is scattered over the construction site or collects there during construction. Those trees, shrubs, vegetative growth, and fencing, if any, which are designed by the Engineer to remain, shall be

preserved and protected as hereinafter specified. Clearing operations shall be conducted so as to prevent damage to existing structures and installations and to those under construction, so as to provide for safety of employees and others.

B. Grubbing: Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs, and any other organic or metallic debris remaining after clearing not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18-inches below the subgrade or the bottom of utility trenches. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

C. Stripping: Remove and dispose of all organics and sod, topsoil, grass, and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. Grass, grass roots and organic material in areas to be excavated or filled shall be stripped to the depth as noted in the soils report. In areas so designated, topsoil shall be stockpiled. Stripped material and unsuitable material, such as organic material, shall be disposed of by the Contractor unless directed otherwise by the Engineer.

    1. In areas so designated, topsoil shall be stripped and stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of by the Contractor.

201-1.3.2. CLEARING AND GRUBBING OPERATIONS

Clearing and Grubbing Limits: All excavation areas associated with new structures, slabs, utilities and roadways shall be cleared and grubbed to the following depths:

A. Proposed Structures: 2-feet below existing grade within a 5-foot margin of each structure and replaced with compacted structural fill material as specified in *Section 201-2.2*

B. Building Site Areas not specifically noted above: 2-feet below existing grade within a 5-foot margin of each building site area and replaced with compacted structural fill material as specified in *Section 201-2.2*.

C. Utility Trenches: 1.5-feet below the bottom of the utility trench within the entire width of the trench and replaced with compacted Class II Soils, Type SW or SP material as specified in *Section 201-2.2*.

D. Roadway and Paved Area: 2-feet below existing grade within a 5-foot margin of areas paved and replaced with compacted common fill material as specified.

E. All Other Areas: 1-foot below completed surface and replaced with compacted common fill material as specified.

Areas to be Stripped: All excavation and embankment areas associated with new structures, slabs, walks, and roadways shall be stripped. Stockpile areas shall be stripped.

201-1.3.3. DISPOSAL OF DEBRIS MATERIAL

A. Disposal of Clearing and Grubbing Debris: The Contractor shall dispose of all material and debris from the clearing and grubbing operations by hauling such material and debris away to an approved disposal site and dispose of in accordance with all local laws, codes, and ordinances. Disposal by burning or burial on-site shall not be permitted. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor, the cost of which shall be included in the contract price.

B. Disposal of Stripped Material: Remove all stripped material and dispose off-site in a legal manner, unless otherwise directed by the Engineer to stockpile the material, such as topsoil, for use in the final Work.

201-1.3.4. PRESERVATION OF TREES AND SHRUBBERY

A. Trees and Shrubbery: All existing trees, shrubbery, and other vegetative material may not be shown on the Drawings. Inspect the site as to the nature, location, size, and extent of vegetative material to be removed or preserved, as specified herein. Preserve, in place, trees that are specifically shown on the Drawings and designated to be preserved.
B. Tree Protection: Those trees which are designated for preservation shall be carefully protected from damage. The Contractor shall erect such barricades, guards, and enclosures as may be considered necessary for the protection of the trees during all construction operations.
C. Preservation and Protection of Trees, Shrubs, and Other Plant Material:
    1. All plant materials (trees, shrubbery, and plants) beyond the limits of clearing and grubbing shall be saved and protected from damage resulting from the work. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line of these trees or plants. The drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a tree, plant, or group of plants. To prevent soil compaction within the drip line area, no equipment will be permitted within this area.
    2. When trees are close together, restrict entry to area within drip line by fencing or a protective barrier. In areas where no fence or barrier is erected, the trunks of all trees 2-inches or greater in caliper shall be protected by encircling the trunk entirely with boards held securely by 10-gauge wire and staples. This protection shall extend from ground level to a height of 6-feet. Neatly cut and remove tree branches where such cutting is necessary to affect construction operations. The cutting and removing must be performed or supervised by an I.S.A certified arborist. Remove branches other than those required to affect the work to provide a balanced appearance of any tree. Scars resulting from the removal of branches shall be treated with a tree sealant.

201-1.3.5. PRESERVATION OF DEVELOPED PRIVATE PROPERTY

A. The Contractor shall exercise extreme care to avoid unnecessary disturbance of developed private property. Trees, shrubbery, gardens, lawns, and other landscaping, which in the opinion of the Engineer must be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.
B. All soil preparation procedures and replanting operations shall be under the supervision of a nurseryman experienced in such operations.
C. Improvements to the land such as fences, walls, outbuildings, etc., which of the necessity of construction activities must be removed, shall be replaced with equal quality materials and workmanship.
D. The Contractor shall clean up the construction site across from developed private property directly after construction is completed upon approval of the Engineer.

201-1.3.6. PRESERVATION OF PUBLIC PROPERTY

The appropriate paragraphs of *Sections 203-2.3.4. and 203-2.3.5*. of these specifications shall apply to the preservation and restoration of all damaged areas of public lands, parks, rights-of-way, easements, etc.

201-1.4. EXCAVATION PROTECTION

201-1.4.1. SHEETING AND BRACING

A. Furnish, put in place, and maintain such sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent utilities or structures, other aboveground structures, utility poles, etc. from being undermined, and to protect workers from

hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier piles and beams or other approved methods. If the Engineer or the city is of the opinion that at any points, sufficient or proper supports have not been provided, they may order additional supports to be put in place at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids from occurring adjacent to the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill, at no additional expense to the city.

B. The Contractor shall construct the sheeting outside the neat lines of the foundation unless deemed otherwise for the Contractor's method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench shall be subjected. Any deformation, movement or bulging which may occur, shall be corrected by the Contractor at his own expense, to provide the necessary clearances and dimensions.
C. Where sheeting and bracing is required to support the sides of excavations for utility structures, other structures, power poles, etc., the Contractor shall engage a Professional Geotechnical Engineer, registered in the state of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall conform to the design, and certification of the installation shall be provided by the Professional Geotechnical Engineer.
D. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
E. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the Engineer or the city may direct him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to any structures or property, whether public or private. The Engineer or the city may direct that timber or steel sheeting used for sheeting and bracing be cut off at any specified elevation.
F. The right of the Engineer or the city to order sheeting and bracing to be left in place shall not be construed as creating any obligation on their part to issue such orders, and their failure to exercise their right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
G. Steel or wood sheeting installed for utility pipeline construction shall not, under any circumstances be withdrawn, if driven below the top of any utility pipeline. Steel sheeting, soldier piles and wood sheeting earth support systems installed for utility pipeline construction shall be cut-off and left-in-place at least 3-feet below the ground surface, but no lower than 2-feet above the top of the utility pipe.
H. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the new construction or other structures, utilities, or property outside the construction area. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by compacting with tools specifically adapted to that purpose, or otherwise as may be directed by the Engineer or the city.

201-1.5. EXCAVATING FOR UTILITY STRUCTURES

Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

Excavation shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, for installing the pipelines, and for all other work required.

A. Excavation for precast or prefabricated structures shall be carried to an elevation two (2) feet lower than the proposed outside bottom of the structure to provide space for the backfill and bedding material.
B. Excavation for structures constructed or cast-in-place in dewatered or dry excavations shall be carried down to the 2-feet below the bottom of the structure where dewatering methods are such that a dry evacuation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete.

Prior to backfilling, document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during excavation and construction. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the work.

Encounters with subsurface obstructions shall be hand excavated.

Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or caused by other construction methods, shall be removed and replaced with crushed stone as required by the Engineer at the Contractor's expense.

The bottom of excavations shall be rendered firm and dry before placing any structure or pipe. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor, in a legal manner. The bedding schedule for pipes shall be as shown in *Table 201-C*.

If the sub-grade is unsuitable, the Contractor shall, remove and replace all unsuitable material below pipe with selected common fill or bedding rock, compacted to 95 percent Modified Proctor density.

All pavements and sidewalks shall be cut prior to removal, with saws or accepted power tools.

Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.

All structure and pipe locations and elevations as required herein must be permanently documented by the Contractor, on the As-Builts, prior to the Engineer's approval of the Application for Payment for that work.

201-1.6. TRENCH EXCAVATION FOR UTILITY PIPELINES

201-1.6.1. TRENCH EXCAVATION FOR PIPE LAYING - GENERAL

A. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. Four hundred (400) feet shall be the maximum length of open trench for any pipeline under construction. All trench excavation shall be open cut from the surface.
B. Alignment, Grade, and Minimum Cover: The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith shall be in conformance with the requirements of *Section 500* covering installation of pipe.
C. Where pipe grades or elevations are not definitely fixed by the Contract Drawings, trenches shall be excavated to a depth sufficient to provide a depth of backfill cover over the top of the pipe of Between the range of 30- 42-inches. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes conduits, drains, drainage structures, or

other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation.

201-1.6.2. LIMITED TRENCH WIDTHS

A. Trenches shall be excavated to a width which shall provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. However, minimum permissible sidewall clearances between the installed pipe and each trench wall, expressed in inches, shall be as follows:

Nominal Pipe Size, in Inches	Nominal Sidewall Clearance, in Inches
60	24
54	21
48	19
36 or smaller	12

B. Stipulated minimum sidewall clearances are not minimum average clearances but are minimum clear distances which shall be required.

C. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interface with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one foot above the top of the pipe.

201-1.6.3. MECHANICAL EXCAVATION

The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, and other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

Mechanical excavation equipment used for trench excavation shall be of the type, design, and construction, and shall be so operated, such that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that the pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance shall not be permitted.

201-1.6.4. PAVEMENT CUTTING

Cuts in concrete pavement, asphalt pavement, and asphaltic base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with an asphalt or concrete saw in a manner which will provide a clean groove for the full depth of pavement along each side of the trench and along the perimeter of cuts for structures.

Asphalt pavement and asphaltic base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6-inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting shall be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the centerline of the trench.

Pavement removed for connections to existing lines or structures shall not be greater than necessary for the installation as determined by the Engineer. Road restoration shall be full road width.

201-1.6.5. ARTIFICIAL FOUNDATIONS IN TRENCHES

Whenever so ordered by the Engineer due to the presence of unsuitable material at the designed depth, the Contractor shall excavate to such depth below grade as the Engineer may direct and the trench bottom shall be brought to grade with such material as the Engineer may order installed. All piling, concrete, or other

foundations made necessary by unstable soil shall be installed as directed by the Engineer. Compensation for extra excavation and piling, concrete, or other foundations, except where provided by contract unit prices, shall be made in accordance with the contract provisions for extra work.

201-1.6.6. BELL HOLES

Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

201-1.7. UNDERCUT OF EXCAVATIONS

If the bottom of any structure or trench excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, the Contractor shall refill to normal grade with approved fill at his own cost. Fill material and compaction method shall be as directed by the Engineer.

201-1.8. STABILIZATION OF EXCAVATIONS

Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact.

Subgrades for concrete structures or trench bottoms which are otherwise solid, but which becomes mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. Not more than 1/2-inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations shown on the Drawings.

All stabilization work shall be performed by and at the expense of the Contractor.

201-1.9. BACKFILL AND COMPACTION

201-1.9.1. MATERIALS

A. To the maximum extent available, excess earth obtained from structure and trench excavation shall be used for the construction of fills and embankments.
B. Materials used as backfill shall be free from rocks or stones larger than 1-1/2-inches in their greatest dimension; brush or vegetation, stumps, logs, roots, debris, and organic or other deleterious materials; and must be acceptable to the Engineer.
C. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials be in any backfill, fill or embankment.

201-1.9.2. BACKFILL PLACEMENT AND COMPACTION

A. Backfill materials shall be placed in approximately horizontal layers not to exceed 8-inches in un-compacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.
B. Each layer of material being compacted shall have the optimum uniform moisture content to ensure satisfactory compaction. The Contractor shall be required to add water and harrow, disc, blade, or otherwise work the material in each layer to ensure uniform moisture content and adequate compaction.

C. Each layer shall be thoroughly compacted by rolling or other method acceptable to the Engineer to 95% of relative density at optimum moisture content as determined by Modified Proctor Method, ASTM D1557, latest revision.
D. Whenever a trench passes through a backfill or embankment area, material shall be placed and compacted to an elevation 12-inches above the top of the pipe before the trench is excavated.
E. Backfill and compact excavations and construct embankments for structures according to the schedule listed in *Table 201-B*. Backfill and bedding schedule for pipes is listed in *Table 201-C*. (Modified Proctor for compaction shall be as determined by ASTM D-1557, latest revision).
F. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.
G. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.
H. Embankments shall be constructed true to lines, grades and cross sections shown on the plans or ordered by the Engineer or the city. Embankments shall be placed in successive layers of not more than 8-inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.
I. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the Engineer. Approval will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The Engineer's approval shall be in writing.

201-1.9.3. STRUCTURE FOUNDATION PREPARATION

The existing ground beneath proposed tankage, building foundations and equipment base slabs and slabs on grade shall be removed and the area proof rolled. Proof-rolling should consist of at least 10 passes of a self-propelled vibrator compactor capable of delivering a minimum impact force of 30,000 to 35,000 pounds per drum to the soils. Each pass should overlap the preceding pass by 30 percent to insure complete coverage. Backfilled areas shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557, latest revision, for a depth of not less than 2-feet below the bottom of the foundations or concrete slabs. Any unsuitable foundation material shall be removed and replaced with suitable material.

Slabs on Grade: Subgrades for concrete slabs shall be removed, backfilled, and compacted to the required grade. The top 2-feet of concrete slab subgrade in cut sections and all fill material shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557, latest revision.

201-1.10. DRAINAGE FROM EXCAVATIONS

Trenches across roadways, driveways, walks, or other traffic ways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the traffic way to prevent impounding water after the pipe has been laid.

Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches.

All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original sections, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

201-1.11. FINAL GRADING

After other outside work has been finished, and backfilling completed and settled, all areas on the site of the work which are to be graded shall be brought to grade within the tolerance of ± 0.1 feet at the indicated elevations, slopes, and contours where seeding or sodding is not required or, where sodding is required within three (3) inches of finished grade. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to hand work. All surfaces shall be graded to secure effective drainage. Unless otherwise shown, a slope of at least one percent shall be provided.

After grading and where seeding is required, topsoil shall be evenly spread to a minimum depth of six (6) inches. Topsoil shall be from an Engineer approved source and shall be free of trash, debris and surface vegetation.

Grading and surfacing shall be completed to the satisfaction of the Engineer and the Owner.

201-1.12. EXCESS EXCAVATED MATERIAL

Insofar as needed, suitable excavated materials shall be used in fills and embankments as shown on the Drawings. All suitable excess excavated material shall be placed at an on-site stockpile area as directed by the city.

The Contractor shall segregate different types of excavated materials (i.e. sands, clayey sands) as much as possible in the stockpile areas. All unsuitable materials shall be disposed of by the Contractor offsite, in a legal manner.

The Contractor shall slope and compact the stockpile with a light roller type vehicle to maintain stability.

The Contractor shall maintain proper soil and erosion control measures.

201-1.13. SETTLEMENT

The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within the guarantee period stipulated in the General Conditions of the Contract.

The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer or the city.

TABLE 201-A

STANDARD SIZES OF COARSE AGGREGATE AMOUNTS FINER

THEN EACH LABORATORY SIEVE (SQUARE OPENINGS), MASS PERCENT

		U. S. Sieve Size, Percent Passing By Weight								
Aggregate Size No.	Nominal Size Square Openings	1-1/2-in	1-in.	3/4-in.	1/2-in.	3/8-in.	No. 4	No. 8	No. 16	No. 50
57	1-in. to No. 4	100%	95%-100%	--	25%-60%	--	0-10%	0-5%	--	--
68	3/4-in. to No. 8	--	100%	90%-100%	--	30%-65%	5%-25%	0-10%	0-5%	--
78	1/2-in. to No. 8	--	--	100%	90%-100%	40%-75%	5%-25%	0-10%	0-5%	--
89	3/8-in. to No. 16	--	--	--	100%	90%-100%	20%-55%	5%-30%	0-10%	0-5%

TABLE 201-B

COMPACTION AND BACKFILL SCHEDULE

FOR STRUCTURES

Area	Material	Compaction
Beneath structures, foundations, slabs, and pavements. (minimum 2-foot depth below concrete foundation bottom)	Structural Fill (*Section 201-2.2.*, Structural Fill)	8-inch lifts compacted to 95% Modified Proctor maximum dry density (98% Modified Proctor maximum dry density under pavement). Fill should not be placed over any in-place soils until those layers have been compacted to 95% Modified Proctor maximum dry density (98% Modified Proctor maximum dry density under pavement).
Around structures, foundations and slabs (minimum 5-foot outside structure)	Structural Fill (*Section 201-2.2.*, Structural Fill)	8-inch lifts compacted to 95% Modified Proctor maximum dry density (98% Modified Proctor maximum dry density under pavement). Use light rubber-tired or vibratory plate compactors.
From cleared existing surface to subgrade for paved and gravel roadway surfaces	Common Fill (Section 201-2.2., Common Fill)	12-inch lifts, compacted to 95% Modified Proctor maximum dry density (98% Modified Proctor maximum dry density under pavement).
Disturbed area requiring seeding and mulching	Topsoil	2-inch to 4-inch lifts, compacted to 85% Modified Proctor maximum dry density.

202. OBSTRUCTIONS

Any pipes, conduits, wires, mains, footings, driveways, or other structures encountered shall be carefully protected from damage or displacement. Any damage thereto shall be fully, promptly, and properly repaired by the Contractor to the satisfaction of the Engineer and the city of Clearwater thereof. Any survey monument or benchmark which must be disturbed shall be carefully referenced before removal, and unless otherwise provided for, shall be replaced upon completion of the work by a Florida registered Professional Surveyor and Mapper (PSM). Any concrete removed due to construction requirements shall be removed to the nearest expansion joint or by saw cut. Contractor shall consult Inspector/Project Manager for the approved means of removal and replacement.

203. DEWATERING

203-1. GENERAL

The work to be performed under this Section shall include the design and installation of a temporary dewatering system(s) until completion of construction to remove subsurface waters from structure or utility trench excavations as required. The Contractor shall furnish all equipment; labor and materials necessary to remove storm water or subsurface groundwater from excavation areas in accordance with the requirements set forth, as shown on the Drawings, and/or geotechnical report.

Qualifications: For major dewatering activities the temporary dewatering system shall be designed, installed and operated by a firm who regularly engages in the design, installation and operation of dewatering systems and who is fully experienced, reputable, and qualified in the design, installation and operation of such dewatering systems. The firm shall have a successful record of operation for a minimum of five (5) years prior to bid date. The dewatering system firm shall have experience for installation of at least three (3) successful dewatering operations of a similar nature and size in the state of Florida.

The dewatering system shall be developed to the point that it is capable of dewatering the site surrounding all structures or utility trenches as shown on the Drawings. Each dewatering system shall be capable of dewatering and maintaining groundwater levels at the respective excavations. Observation wells shall be constructed for the purpose of testing each system.

The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove and dispose of all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. In critical dewatering situations, the Contractor shall have on hand at the construction site, backup dewatering pumps and other critical components of the dewatering system that are operational and could be used in the event of breakdowns of the primary equipment.

The Contractor's plan shall include temporary culverts, barricades, and other protective measures to prevent damage to property or injury to any person or persons.

Prior to construction, the dewatering plan shall be prepared and submitted to the city's Engineering Department, Public Utilities Department, Industrial Pretreatment Program (IPP) Coordinator, Wastewater Environmental Manager and the Public Utilities Department Director or Assistant Director for review and approval. It shall include site-specific notes and details presenting the Contractor's proposed dewatering and disposal methods. The city will field-inspect the dewatering operation throughout construction.

All costs for dewatering shall be included in the unit price bid per linear foot of pipe, or, in the case of other underground structures, in the cost of such structures.

203-1.1. Definition of Terms for Dewatering System

Minor Dewatering Activity: A single stage well point dewatering system, operating for less than 30 days total duration, and not requiring a Notice of Dewatering Activity filed with the local Water Management District.

Major Dewatering Activity: Any major dewatering system, operating for more than 30 days duration, requiring a Notice of Dewatering Activity filed with the local Water Management District. Major dewatering systems shall include, but not be limited to, multi-stage well point dewatering systems, drilled horizontal or vertical sock drain systems, dewatering deep well pump systems and educator dewatering systems.

203-2. OBSERVATION WELLS

For major dewatering activities, prior to excavation, the Contractor shall install groundwater observation wells at locations as directed and designed by the Contractor's Geotechnical Engineer and as approved by the Engineer adjacent to structures or underground utility under construction for the purpose of monitoring water levels during excavations.

Where required, the observation well construction shall consist of well screen, casing, and cap of approved size and material of construction. The observation well shall be placed in a 2-1/2-inch bore hole which shall be carried to an elevation at least 4 feet below the final bottom grade of structure or utility trench excavation. The annular space surrounding the intake point and the riser pipe shall be sealed in such a way as to prevent infiltration from surface water. The observation well shall be developed in such a manner as to ensure proper indication of subsurface water levels adjacent to the well.

The Contractor shall be responsible for maintaining the observation wells and for observing and recording the elevation of groundwater until the structure or utilities requiring excavation are completed and backfilled. Each observation well shall be observed and recorded daily. Measurements shall be supplied daily to the Engineer and the city. The Engineer may require that the observation wells reflect true groundwater levels by adding water to the well, recording the drop in the level from the time the water was added. Any plugged observation well shall be redeveloped, if necessary, to indicate true groundwater levels.

Observation wells shall be fully grouted and abandoned when the dewatering system is removed as directed by the Geotechnical Engineer, and in a manner acceptable to the Geotechnical Engineer.

203-3. PUMPING AND DRAINAGE - GENERAL

Unless specifically authorized by the Engineer, all pipes, except sub drains, shall be laid "in the dry". In the dry shall be defined to be within 2 percent of the optimum moisture content of the soil. The Contractor shall dewater trench excavation as required for the proper execution of the work, using one or more of the following approved methods: well point system, trenched gravity under drain system, or sumps with pumps.

Well point systems must be efficient enough to lower the water level in advance of the excavation and maintain it continuously in order that the trench bottom and sides shall remain firm and reasonably dry. The well points shall be designed especially for this type of service, and the pumping unit used shall be capable of maintaining a high vacuum, and at the same time, of handling large volumes of air as well as of water.

Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils 2-feet below the proposed bottom of excavation and to preserve the integrity of adjacent structures. As a minimum, the water level shall be 2-feet below the trench bottom. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding soils. Dewatering by trench pumping shall not be permitted if migration of fine-grained natural material from bottom, side walls, or bedding material may occur.

A well point system, trench drain, sump pump operation, or other dewatering method shall be utilized to maintain the excavation in a dry condition for preparation of the trench bottom and until the structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. No water shall be allowed to contact masonry or concrete within 24 hours after being placed.

Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain the excavation bottom free from standing water.

The Contractor shall take all additional necessary precautions and prevent uplift of any structure during construction.

Flotation of structures or piping shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of the dewatering system.

The conveying of water other than storm water surface runoff in open ditches or trenches will not be allowed unless prior approval is obtained. Permission to use any drainage ditches, storm sewers, drains or other storm drainage facilities for water conveyance or disposal purposes during dewatering operations shall be obtained from the controlling authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and the Contractor shall leave the facilities unrestricted and as clean as originally found. Any damage to existing facilities shall be repaired or restored, as directed by the Engineer or the authority having jurisdiction, at no cost to the city or the Owner of the facilities.

The Contractor shall be responsible for disposing of all water resulting from trench dewatering operations and shall dispose of the water without damage or undue inconvenience to the work, the surrounding area, or the general public. The Contractor may be required to divert the water from the dewatering process to a location determined by the Engineer or city Project Manager or Inspector and obtain a discharge permit from Florida Department of Environmental Protection (FDEP). Alternatively, if Contractor elects to contain produced groundwater on the project site, a dewatering plan must be submitted to the Engineer or city for approval (even if a discharge permit is not required).

The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, or other contaminants in order to prevent adverse effects on groundwater or receiving water quality.

203-3.1. DEWATERING EQUIPMENT

The dewatering equipment shall be standard dewatering equipment of proven ability as designed, manufactured, and installed by firms having experience in the design and production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods.

The Contractor shall provide adequate equipment for the removal of surface or subsurface waters that may accumulate in the excavation. Flotation and migration of fines shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages that may result from the operation and/or failure of this system.

Sound levels for dewatering pumps shall meet governmental agencies ordinance levels. Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels Work stoppage by the Engineer, city or other governmental agencies for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to contract time and contract price. Engine-driven pumps shall be equipped with critical grade type silencers, sound blankets or other types of sound mitigation measures to comply with Noise Ordinances. Engine driven dewatering pumps shall have a maximum rating of 80 decibels at a distance of 5 feet from the engine for sound attenuation, nor shall the pump engine noise exceed 50 decibels at a distance of 50 feet from the engine. There may be practical and feasible, electrical "power drops" and electric motor-driven equipment shall be used in lieu of portable generators.

The dewatering system shall operate in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed structures or utilities and to preserve the integrity of any adjacent structures.

Removal of dewatering equipment shall be accomplished following backfilling and compaction, and after the Contractor and the Engineer both agree, that the system is no longer required. All materials and equipment constituting the dewatering system shall be removed by the Contractor.

Immediately upon completion of the dewatering operations, the Contractor shall remove all of his equipment, materials, and supplies from the site of the Work, remove all surplus materials and debris, fill in all holes or excavations, grout all groundwater monitoring wells installed for the dewatering operations and grade the site to elevations of the surface levels which existed before the work started. The site shall be thoroughly cleaned and graded as directed by the Engineer and approved by the city.

203-3.2. DEWATERING CONSIDERATIONS

The Contractor shall install a temporary dewatering system for the removal of subsurface water encountered during construction of the proposed structures or underground utilities. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters which may accumulate in the excavations.

If well points are used, Contractor shall adequately space well points to maintain the necessary dewatering. Provide suitable filter sand and/or other means to prevent pumping of fine sands and silts. A continual check shall be maintained by the Contractor to ensure that the subsurface soil is not being removed by the dewatering operations. Pumping from well points shall be continuous and standby pumps shall be provided.

The Contractor's proposed method of dewatering shall include groundwater observation wells to determine the water level during construction. Observation wells shall be installed along pipelines as required to verify depth to water level and at locations approved by the Engineer.

At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from the surface shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped or drained by gravity to maintain an excavation bottom free from standing water.

Flotation shall be prevented by the Contractor by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible for all damages which may result from failure to adequately keep excavations dewatered.

The Contractor shall construct and place all pipelines, structures, concrete work, structural fill, backfill and bedding material in-the-dry. If subsurface water is encountered, utilize suitable equipment to adequately dewater the excavation so that it will be “in-the-dry” for work and pipe laying. For the purposes of this specification, “in-the-dry” is defined to be within ±2 percent of the optimum moisture content of the soil. A well point system or other dewatering method accepted by the respective jurisdictional agency (agencies) shall be utilized, if necessary, to maintain the excavation in a dry condition for preparation of the trench bottom and for pipe laying. The Contractor shall not make the final 24-inches of excavation until the water level is a minimum of 2-feet below proposed bottom of the excavation.

Dewatering by trench pumping will not be permitted if migration of fine-grained natural material from bottom, side walls, or bedding material will occur.

In the event that satisfactory dewatering cannot be accomplished due to subsurface conditions or where dewatering could damage existing structures, obtain the Owner’s and the Engineer's approval of wet trench construction procedures before commencing construction.

203-3.3. DISPOSAL OF PUMPED WATER

Discharge water to on-site disposal areas (if shown on the Drawings) or as required by permits.

The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent properties or facilities. No water shall be discharged without appropriate treatment for adverse contaminants. No water shall be drained in work built or under construction without prior consent from the Owner. Water shall be filtered to remove sand and fine soil particles before disposal into any drainage system.

Discharge water from dewatering operations to temporary infiltration pits, if possible.

Discharge to storm sewers, canals, stream, or wetlands, only if specifically allowed for in Dewatering Permit.

No discharges from dewatering operations shall be allowed to wastewater collection systems or wastewater pumping stations at any time.

In no case, shall discharges from dewatering operations result in turbidity reaching wetlands or any waterways. If turbidity exceeds limits allowed by jurisdictional permitting agency(ies), stop all activities, and install additional erosion and sedimentation control as required by the Southwest Florida Water Management District or the FDEP.

Flooding of streets, roadways, driveways, or private property shall not be permitted during dewatering activities. Contractor shall not dam-up, divert, or cause water to flow in excess in existing gutters, roadway pavements or other structures. For proper water discharges and disposal from dewatering operations, the Contractor may be required to divert or provide discharge piping to transport the water to a suitable place for legal discharge, as determined by the Engineer and the city.

203-3.4. GROUNDWATER TREATMENT (IF REQUIRED)

If the concentrations of tested groundwater quality parameters exceed those allowable in the FDEP Generic Permit for the Discharge of Produced Groundwater from any Non-Contaminated Site Activity (62-621.300(2), F.A.C.), the Contractor shall treat the effluent discharged from the dewatering system.

The Contractor shall immediately notify the Engineer and the city Engineering Department and discuss the parameters that exceed allowable limits.

The Contractor shall meet with the FDEP to determine treatment and disposal alternatives that are acceptable to the FDEP.

The Contractor shall apply for and obtain any and all permits and/or treatment approvals that FDEP requires including but not limited to the following:

1. Generic Permit for Discharges from Petroleum Contaminated Sites (62-621.300(1)). Allows discharges from sites with automotive gasoline, aviation gasoline, jet fuel, or diesel fuel contamination; or,
2. Permit for all Other Contaminated Sites (62-04; 62-302; 62-620 & 62-660). The coverage is available only through the individual NPDES permit issued by FDEP, allows discharges from sites with general contaminant issues i.e. ground water and/or soil contamination other than petroleum fuel contamination; or,
3. Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity (62-621.300(2), F.A.C.); or,
4. Generic Permit for Stormwater Discharge from Large or Small Construction Activities (62-621.300(4)(a), F.A.C.); or,
5. An Individual Wastewater Permit (62-604.300(8) (a).

The Contractor shall implement the appropriate treatment that is acceptable to FDEP, the Engineer and the city to attain compliance for all excess limits encountered during dewatering activities. Treatment may include, but is not limited to: Chemical, Physical, Biological, Electrolysis, Ion Exchange, Aeration, Activated Carbon Absorption, or any combination of the these.

The Contractor shall make every effort to minimize the spread of contamination into uncontaminated areas. Provide for the health and safety of all workers at the job site and make provisions necessary for the health and safety of the public that may be exposed to any potentially hazardous conditions. Ensure provision

adhere to all applicable laws, rules or regulations covering hazardous conditions and will be in a manner commensurate with the level of severity of the conditions.

If necessary, provide contamination assessment and remediation personnel to handle site assessment, determine the course of action necessary for site security and perform the necessary steps under applicable laws, rules and regulations for additional assessment and/or remediation work to resolve the contamination issue.

Delineate the contamination area(s) and any staging or holding area required and develop a work plan that will provide the schedule of projected completion dates for the final resolution of the contamination issue.

Maintain jurisdiction over activities inside any delineated contamination areas and any associated staging or holding areas. Be responsible for the health and safety of workers within the delineated areas. Provide continuous access to representatives of regulatory or enforcement agencies having jurisdiction.

203-4. PERMIT REQUIREMENTS

The dewatering of any excavation areas and the disposal of water during construction shall be in strict accordance with the latest revisions of the National Pollutant Discharge Elimination System (NPDES), and all local and state government rules and regulations.

The Contractor shall be responsible for submitting the Notice of Intent to use the Generic Permit for the Discharge of Groundwater from Dewatering Operations and associated fee in accordance with FDEP Requirements, F.A.C. 62-621.300(2)(b) and must receive written notice from the FDEP prior to discharging produced groundwater into the city's streets, storm sewers or waterways.

The Contractor shall obtain and pay all respective fees for all local, state, and federal permits required applicable to the withdrawal, treatment and disposal/discharge of water produced from the dewatering operations, prior to the start of work.

Contractor shall be responsible for acquiring and complying with all permits required to discharge produced water from dewatering and shall protect waterways from turbidity during the operation. Prior to discharging produced groundwater from any construction site, the contractor must collect samples and analyze the groundwater, which must meet acceptable discharge limits per FDEP "Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity" Chapter 62-621.300(2), FAC. The Contractor shall have on-site and available for review the analytical testing results performed in accordance with FDEP Chapter 62-621.300(2), FAC.

Consumptive Use Permit (CUP): If pumping requirements exceed certain limits, the Contractor shall pay for and obtain a CUP from the regional Water Management District for such pumped volumes. If a consumptive use permit is required by the local Water Management District, the Contractor shall be responsible for obtaining said permit. Comply with all conditions of the Dewatering Permit issued by the Water Management District. Apply for permit extensions or modifications, when required.

All water produced from dewatering shall be pumped from the trench or other excavation and shall be disposed of in strict accordance with applicable permits. The Contractor will be allowed to discharge product water from dewatering into storm sewers, or ditches having adequate capacity, canals or suitable disposal pits, or other surface waters in accordance with the Dewatering Plan, provided that the water has been sampled and tested by the Contractor, is in compliance with the concentration limits specified in 62-621.300(2) FAC, and the Contractor has obtained an FDEP Generic Permit for the production of groundwater. The frequency of water sampling and testing shall be determined by the Engineer based on existing conditions and field observations.

204. UNSUITABLE MATERIAL REMOVAL

All unsuitable material, such as muck, clay, rock, etc., shall be excavated from under pipes, structures and roadways and removed from the site. All material removed is property of the Contractor, who shall dispose of said material off-site at their expense. The limits and depths of the excavation shall be determined in the field by the Engineer. Approved replacement materials shall meet the requirements of Section 304.

204-1. BASIS OF MEASUREMENT

The basis of measurement shall be the number of cubic yards of clean fill placed as determined by either cross sections of the excavation, truck measure, or lump sum as specified in the Scope of Work and Contract Proposal. Included in the cost of removing unsuitable material is the cost to place suitable material/clean fill.

204-2. BASIS OF PAYMENT

The unit price for the removal of unsuitable material shall include: all materials, equipment, tools, labor, disposal, hauling, excavating, dredging, placing, compaction, dressing surface and incidentals necessary to complete the work. If no pay item is given, the removal of unsuitable material shall be included in the most appropriate bid item.

205. UTILITY TIE IN LOCATION MARKING

The tie in locations for utility laterals of water, sanitary sewer, and gas shall be plainly marked on the back of the curb. Marking placed on the curb shall be perpendicular with respect to the curb of the tie in location on the utility lateral. Marks shall not be placed on the curb where laterals cross diagonally under the curb. The tie in location shall be the end of the utility lateral prior to service connection.

Markings shall be uniform in size and shape and colors in conformance with the current code adopted by the American Public Works Association:

SAFETY RED	Electric Power Lines, Cables, Conduit and Lighting Cables
HIGH VISIBILITY SAFETY YELLOW	Gas, Oil, Steam, Petroleum or Gaseous Materials
SAFETY ALERT ORANGE	Communication, Alarm or Signal Lines, Cables or Conduit
SAFETY BLUE	Potable Water
SAFETY GREEN	Sewer Systems and Drain Lines
PURPLE	Reclaimed Water, Irrigation and Slurry Lines
WHITE	Proposed Excavation
PINK	Temporary Survey Markings

Marks placed on curbs shall be rectangular in shape and placed with the long dimension perpendicular to the flow line of the curb. Marks placed on valley gutter and modified curb shall be six-inch (6”) x three inch (3”) and placed at the back of the curb. Marks placed on State Road and vertical curb shall be four-inch (4”) x two inch (2”) and be placed on the curb face.

206. CLEARING AND GRUBBING

The work included in this specification includes the removal and disposal of all structures, appurtenances, asphalt, concrete, curbs, walls, trees, roots, vegetation, boulders, conduits, poles, posts, pipes, inlets, brush, stumps, debris and other obstructions resting on or protruding through the ground surface necessary to prepare the area for construction.

Clearing and grubbing shall be performed in accordance with *Section 110 of FDOT's Standard Specifications*. Unless otherwise specified in the contract documents, the Contractor shall take ownership of all removed material and dispose of them off-site in accordance with all Local, State and Federal Requirements.

206-1. BASIS OF MEASUREMENT

The basis of measurement shall be either a lump sum quantity or the number of acres cleared and grubbed as specified on the plans or directed by the Engineer.

206-2. BASIS OF PAYMENT

The pay item for clearing and grubbing shall include: all removal and disposal of materials and structures as well as all materials, hauling, equipment, tools, labor, leveling of terrain, landscape trimming and all incidentals necessary to complete the work.

207. EROSION AND SEDIMENT CONTROL

207-1. GENERAL

Erosion and sediment control shall conform to the requirements of the FDOT Standard Specifications for Prevention, Control, and Abatement of Erosion and Water Pollution. Contractor shall use temporary erosion and sediment control features found in the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (E&SC Manual) or the city of Clearwater Standard Indices. Contractor shall prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) and National Pollutant Discharge Elimination System (NPDES) permit in accordance with FDEP criteria for an NPDES construction activity permit.

Visit www.dep.state.fl.us/water/stormwater/npdes for more information. Contractor shall obtain a FDEP generic permit for the discharge of produced groundwater. All soil erosion and sediment control measures shall be installed prior to disturbance and maintained through project completion.

207-2. TRAINING OF PERSONNEL

The city may require that the Supervisor or Foreman controlling the work for the Contractor on the Project have a current FDEP Florida Stormwater, Erosion, and Sedimentation Control Inspector Training & Certification. All personnel working on the Project shall complete illicit discharge training once per calendar year. Contractor shall provide documentation to the city prior to Notice to Proceed (NTP). Example of training and training sign-in sheet will be provided by the city to the Contractor at the Pre-Construction Meeting.

207-3. STABILIZATION OF DENUDED AREAS

No disturbed area may be denuded for more than thirty (30) calendar days unless otherwise authorized by the City Engineer. During construction, denuded areas shall be covered by mulches such as straw, hay, filter fabric, seed and mulch, sod, or some other temporary vegetation. Within sixty (60) calendar days after final grade is established on any portion of a project site, that portion of the site shall be provided with established permanent soil stabilization measures per the original site plan, whether by impervious surface or landscaping.

207-4. PROTECTION AND STABILIZATION OF SOIL STOCKPILES

Fill material stockpiles shall be protected at all times by on-site drainage controls which prevent erosion of the stockpiled material. Control of dust from such stockpiles may be required, depending upon their location and the expected length of time the stockpiles will be present. In no case shall an un-stabilized stockpile remain after thirty (30) calendar days.

207-5. PROTECTION OF EXISTING STORM SEWER SYSTEMS

During construction, all storm sewer inlets in the vicinity of the project shall be protected by temporary erosion and sediment control features found in the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (E&SC Manual) or the city of Clearwater Standard Indices, or equals approved by the City Engineer before installation.

207-6. SWALES, DITCHES AND CHANNELS

All swales, ditches and channels leading from the site shall be sodded within three (3) days after finished grade is established. All other interior swales, etc., including detention areas will be sodded and maintained by the Contractor prior to issuance of a Certificate of Occupancy.

207-7. UNDERGROUND UTILITY CONSTRUCTION

The construction of underground utility lines and other structures shall be done in accordance with the following standards: no more than 400 linear feet of trench shall be open at any one time; and, wherever consistent with safety and space consideration, excavated material shall be cast to the uphill side of trenches. Trench material shall not be cast into or onto the slope of any stream, channel, road ditch or waterway. No trench shall be open at the end of a workday, weekdays, or weekends.

207-8. MAINTENANCE

All erosion and siltation control devices shall be checked daily by the Contractor, especially after each rainfall. The erosion and sedimentation control devices shall be cleaned out and/or repaired as required so sediment removal for the device does not exceed fifty (50) percent of its capacity. Contractor shall prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) Construction Inspection Report on a weekly basis and within 24 hours of a storm that is 0.50 inches or greater. No additional payment will be made to the Contractor for the re-establishment of erosion control devices which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the Project. Near completion of the project, after obtaining written approval by the Engineer, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion control devices in seeded areas shall be left in place until the grass is established. Seed areas around devices, and mulch after removing or filling temporary control devices. Cleanup all areas.

207-9. COMPLIANCE

Failure to comply with the aforementioned requirements as determined by the city's project manager or inspector may result in a fine and/or more stringent enforcement procedures such as (but not limited to) issuance of a "Stop Work Order".

208. CONSTRUCTION AND REPAIR OF SEAWALLS AND OTHER BEACH EROSION CONTROL STRUCTURES

208-1. EXISTING SEAWALLS AND REVETMENTS

Existing seawalls and revetments on natural water bodies may be replaced with a revetment or with a vertical seawall with the provision of rip rap placed at the base of the wall up to the mean high water line for the entire length of the seawall. Revetments and seawalls may be replaced with a vertical seawall in manmade water bodies, provided that the seawall is within the property line and maintains the established shoreline.

208-2. TOP OF CAP ELEVATION

The top of cap elevation for all replacement and new seawalls and seawall caps shall not exceed 4.8 feet North American Vertical Datum (NAVD 88) If the top of a seawall cap is constructed at an elevation differing from the adjacent property owner top of cap elevation by greater than one foot, then a return wall is required to sufficiently provide for the break in grade at the property line. Seawalls exceeding 4.8 feet NAVD 88 in height prior to the effective date of this Section may be maintained, repaired, and replaced to their current height.

208-3. SEAWALLS AND REVETMENTS LOCATED SEAWARD OF THE CCL

Seawalls and revetments located seaward of the coastal construction setback line are controlled by regulations of the Division of Beaches and Shores of the Florida Department of Environmental Protection. Replacement of a seawall or revetment that is located seaward of the coastal construction setback line necessitates submission of a permit application to the state department of environmental protection.

208-4. PLACEMENT OF NEW SEAWALL

The placement of a new seawall waterward of an existing seawall is permitted, subject to the following conditions:

A. A Florida registered professional engineer must certify the new seawall design.
B. The new seawall shall not extend more than 18 inches from the waterward face of the original alignment of the existing vertical seawall location.
C. The new seawall shall be placed vertically plumb.
D. Placing a seawall in front of an existing seawall shall only be permitted once unless the seawall behind the new seawall is removed.
E. Existing seawall sections that interfere with new seawall location shall be removed.
F. The new seawall shall include an adequate closure of gaps at each property line.
G. For zoning purposes, the setbacks for the property will be measured from either the property line or the waterside of the original seawall slab, whichever is more restrictive, and will not be adjusted to accommodate the new seawall addition. For purposes of pier construction, the shore normal dimensions will be measured from the waterside of the original seawall slab.

208-5. POST CONSTRUCTION SURVEY

Prior to final inspection and approval of a new or replacement seawall or seawall cap, a post-construction survey shall be required. Repairs of existing seawalls and seawall caps which do not alter the height or location shall not be subject to this requirement.

208-6. RIP-RAP

On all-natural waterways, an apron of rip-rap shall be placed at the base of all new and repaired seawalls up to the mean high water line for the entire length of the seawall to absorb the wave energy and protect the underlying soft earth or sand from being carried away, as well as to provide habitat for desirable marine species. This rip-rap shall be required at the base of all new seawalls and at the time that an existing seawall is repaired where the replacement constitutes greater than 50 percent of the entire length of the seawall or includes the replacement of a panel.

208-7. RETAINING WALL IN LIEU OF VERTICAL SEAWALL

A retaining wall may be built as an alternative to a vertical seawall, provided that all activities, including dredging, filling, slope grading, or equipment access and similar activities and all portions of the wall are located landward of the mean high water line.

209. MAINTENANCE OF OPERATIONS

209-1. GENERAL

This Section sets forth the requirements for scheduling and performing the work to keep existing utilities in continuous, reliable operation.

The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to maintain existing utilities service during construction. Contractor shall also keep on hand adequate equipment, supplies, and incidentals to repair pipe breaks and to contain and dispose of all spilled materials.

209-2. EXECUTION

A. Before any work begins, the Contractor shall submit for city review a Maintenance of Flow Plan. The Maintenance of Flow Plan shall include all procedures to be performed by the Contractor to maintain continuous operation of the city's existing utility services. The Plan shall also include emergency response and remedial action measures.

   Maintenance of Flow Plan:

   1. The Contractor shall prepare a Maintenance of Flow Plan with two points of contact that describes in detail the work that will be performed by the Contractor to maintain continuous operation of the city's existing utility services. Maintenance of Flow Plan shall address the temporary and permanent flow diversion of utilities and other city facilities.
   2. Temporary diversion of the utility flows shall be done using a minimum of two (2) bypass pumps (one duty, one standby) to pump from the upstream manhole to the downstream manhole. Bypass pumps shall have hospital grade sound attenuation. The Contractor shall obtain peak wet weather flow rates in the utility from the city and shall demonstrate in the Maintenance of Flow Plan that adequate pumping capacity is provided to accommodate peak wet weather flow. The Contractor and city personnel that are experienced in the

collection system shall determine the float levels in the field, pump on, standby or lag pump on, and high-level alarm. The Contractor shall have full responsibility for the operation and management of the temporary diversion/ bypass. The high-level alarm shall be connected to an auto dialer or remote monitoring system to notify the Contractor of an alarm condition. The bypass pump suction manhole shall use the collection system for a temporary wet well storage; however, surcharging in the existing utility system shall be limited. Once the high-level float alarm is triggered, it shall allow enough time for emergency Contractor personnel to arrive on scene and resolve the problem prior to any utility overflows. The bypass suction and discharge pipes may require the removal of the manhole tops which will result in excess odor escaping from the manholes. The Contractor shall provide a means to seal odors within the bypass manholes to minimize odors during the temporary diversion.

3. The Maintenance of Flow Plan shall include a sequence of construction with projected time, in days, for each step in the sequence.
4. If the work required to maintain utility operation must occur during evening, night or weekend hours, the Contractor shall notify the affected residents in advance of the projected work. The Contractor shall reimburse the city for overtime work, including inspector overtime, in excess of regular working hours. The Contractor must also get permission from city Project Manager before working outside of Noise Ordinance hours.
5. Identify the person(s) responsible for executing the Maintenance of Flow Plan and the systems to be put in place for monitoring the existing utility system's ability to maintain flow.

B. All utility relocation work shall be completed prior to construction. The Contractor shall familiarize himself with the site, including the locations, sizes, and conditions of the existing utilities in and around the work zones where relocation of existing utilities is required. The location of storm sewer inlets, drainage swales, and runoff patterns should be identified, and a Plan developed to contain potential releases.

C. The Contractor shall carry out his operations in accordance with all applicable OSHA regulations, including confined space entry requirements, as well as local, city, and state requirements, and in accordance with the approved MOT plan. In addition, the Contractor shall protect the public from harm while performing the work by using barricades, warning lights and other means as necessary.

D. The Contractor shall keep existing utilities in service during all phases of construction and coordinate any system shutdowns with the city sufficiently in advance to provide alternative service. The Contractor shall provide a minimum of 10 days' notice. Contractor shall protect the city's utility system for any spills or overflows during construction. The city's Project Manager and Dispatch (727-462-6633) shall be notified of any spills or overflows immediately.

E. Any temporary work, facilities, roads, walks, protection of existing structures, piping, blind flanges, valves, equipment, etc. that may be required shall be furnished and maintained by the Contractor. The cost shall be included in the appropriate bid items.

F. The Contractor shall schedule the work in such a manner so that all existing utility systems are maintained in continuous operation. All short-term or partial utility system shutdowns shall be approved in writing by the city. If, in the opinion of the city, a shutdown is not required in order for the Contractor to perform the work, the Contractor shall utilize alternative methods to accomplish the work. The city shall be provided a minimum of ten (10) business days' notice of Contractor's need for any existing utility system shutdown or if there is a need of assistance from the Public Utilities Department. Contractor must also provide the city with at least two (2) business days' notice before Contractor is allowed to work at city facilities.

G. Required shutdowns shall not begin until all materials are on-hand, pre-assembled, as possible, and ready for installation. Upon commencement of the shutdown period, the Contractor shall proceed with the work continuously, start to finish, until the work is completed, and the system is tested, cleared for service, and ready for operation. If the Contractor completes all required work before

the specified shutdown period has ended, the city may immediately place the system back in service.

H. The city shall have the sole authority to prohibit or order work stopped. The city reserves the right to cancel scheduled shutdowns if conditions warrant. Delays to the Contractor caused by cancellations will be considered in evaluating requests for a time extension. They will not be considered an entitlement to additional compensation. However, compensation may be considered at city's sole discretion.

I. During inclement weather, all work which might be damaged or rendered inferior by such weather conditions shall be suspended. The orders and decisions of the city as to suspensions shall be final and binding. During suspension of the work from any cause, the work shall be suitably covered and protected to preserve it from injury by the weather or otherwise, if the city shall so direct surplus materials shall be removed. Contractor shall protect the city's utility system from inflow during inclement weather during the construction.

J. The Contractor shall submit a Critical Path Method (CPM) work schedule at the pre-construction meeting showing all critical items of work and anticipated shut down times. Note that no activity will be allowed until the CPM is approved by the city or the Engineer of Record (EOR).

K. Contractor must submit a detailed schedule and process description for proposed testing. Training of all new equipment must be videotaped including two weeks of training prior to startup. If there are multiple sites under the same contract each site startup shall occur as soon as it is complete. If there are multiple shifts at any site(s) where city staff require training, Contractor shall hold multiple trainings convenient for each shift.

L. Required shutdowns shall not begin until all materials are on-hand, pre-assembled to the extent possible, and ready for installation. Upon commencement of the shutdown period, the Contractor shall proceed with the work continuously, start to finish, until the work is completed, and the system is tested, cleared for service, and ready for operation. If the Contractor completes all required work before the specified shutdown period has ended, the city may immediately place the system back in service.

209-3. BASIS OF MEASUREMENT

There shall be no separate measurement and payment for this task.

210. DETECTION OF FACILITIES

The locations of all existing underground piping, structures, and other facilities are shown based on information received from the respective owner. The locations are shown without express or implied representation, assurance, or guarantee that they are complete, correct, or a represent a true picture of the actual underground facilities to be encountered. It is the Contractor's responsibility to verify the correct location and sizing of all utilities (including connection points).

All appropriate utility companies and agencies shall be contacted 72 hours prior to excavation. Call "One Call"/ "Sunshine 811" at 8-1-1; "Sunshine 811" administrative offices may be reached at (800) 638-4097.

The Contractor shall at all times employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of existing utilities or cause interference.

The Contractor shall conduct exploratory excavations as necessary for the purpose of locating underground pipelines, structures, and utilities in advance of construction. Test pits shall be excavated in areas of potential conflicts between existing and proposed facilities and at piping connections to existing facilities a minimum of 48 hours and 1000 ft in advance of work. If there is a potential conflict, the Contractor shall notify the Owner and Engineer immediately and provide as much information as possible including but not

limited to location, elevation, utility type, material, and size. Test pits shall be backfilled immediately after their purpose has been satisfied. There shall be no additional compensation for exploratory excavations.

211. RELOCATIONS

211-1. RELOCATION SHOWN ON DRAWINGS

Relocations shown on the Drawings: Public utility installations or structures, including but not limited to poles, signs, fences, piping, conduits and drains that interfere with the positioning of the work which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as part of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made, therefore.

All existing castings, including valve boxes, junction boxes, manholes, hand holes, pull boxes, inlets and similar structures in the areas of construction that are to remain in service and in areas of trench restoration and pavement replacement, shall be adjusted by the Contractor to bring them flush with the surface of the finished work.

All existing utility systems which conflict with the construction of the work herein, which can be temporarily removed and replaced, shall be accomplished at the expense of the Contractor. Work shall be done by the utility unless the utility approves in writing that the Work may be done by the Contractor.

211-2. RELOCATIONS NOT SHOWN ON DRAWINGS

Where public utility installations or structures are encountered during the course of work, and are not indicated on the Drawings or in the specifications, and when in the opinion of the city, removal, relocation, replacement, or rebuilding is necessary to complete the work, such work shall be accomplished by the utility having jurisdiction or such work may be requested in writing by the city for the Contractor to perform and fairly compensated once work is complete.

If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement, or rebuilding as necessary.

212. RESTORATION PROCEDURES

212-1. INTERIM RESTORATION

All excavations shall be backfilled and compacted as specified by the city and Engineer at the end of each working day. For excavations within existing paved areas, the limerock base or soil cement base shall be spread and compacted to provide a smooth surface free of aggregate material. The Contractor shall keep the site accessible to the city Staff at all times for the purpose of operating and maintaining the existing facility during construction.

All pipe and fittings shall be neatly stored in a location, which will cause the least disturbance to the public. All debris shall be removed and properly disposed of by the end of each working day.

212-2. FINAL RESTORATION

After completing all installations, pressure testing, bacteriological testing, and associated work, final restoration shall be performed. In no event shall final restoration begin after substantial completion. Any

additional restoration required after testing shall be repaired in a timely manner at no additional cost to the city. Maintenance of all restored facilities shall be the Contractor's responsibility. This maintenance shall be performed on an on-going basis during the course of construction. The Contractor's Progress Schedule shall reflect the above restoration requirements.

300 SERIES: MATERIALS

301. CONCRETE

The Contractor shall notify the Construction Inspector a minimum of twenty-four (24) hours in advance of all concrete placements. Contact Building Inspectors from the city Planning Department if building a structure is required. The Contractor shall give Building Inspectors a minimum of 48 hours in advance to inspect.

Unless otherwise noted elsewhere or directed, the following requirements shall be adhered to:

All concrete work shall be performed in accordance with the latest editions of the Design and Control of Concrete Mixtures by the Portland Cement Association, the American Concrete Institute, and FDOT's Standard Specifications. Unless otherwise specified, all concrete shall have fiber mesh reinforcing and have a minimum compressive strength of 3000 psi at twenty-eight (28) days. The cement type shall be Type I and shall conform to AASHTO M85 latest edition. The aggregate shall conform to ASTM C33 or latest current edition. All ready-mix concrete shall conform to ASTM C94 or latest edition. The slump for all concrete shall be in the range of three inches (3") to five inches (5"), except when admixtures or special placement considerations are required.

All concrete shall be tested in the following manner:

Placement of less than five cubic yards (5 cy) shall be tested at the Engineer's discretion. Otherwise, for each class, for each day, for every fifty cubic yards (50 cy) or part thereof exceeding five cubic yards (5 cy), one set of three (3) compressive strength cylinders will be required (1 at 7 days and 2 at 28 days). At the discretion of the Engineer, unacceptable test results may require the Contractor to provide further tests, as determined by the Engineer, to determine product acceptability, or need for removal, and compensation or denial thereof.

302. EXCAVATION AND FORMS FOR CONCRETE WORK

302-1. EXCAVATION

Excavating for concrete work shall be made to the required depth of the subgrade or base upon which the concrete is to be placed. The base or subgrade shall be thoroughly compacted to a point six inches (6") outside said concrete work before the forms are placed.

302-2. FORMS

Forms for concrete work shall be either wood or metal, except curbs. Curb forms shall be metal only, unless at radius, intermittent sections less than ten (10) linear feet or with written permission from the Engineer. The forms shall be free from warps or bends, shall have a depth equal to the dimensions required for the depth of the concrete deposited against them and shall be of sufficient strength when staked to resist the pressure of concrete without moving or springing.

303. REINFORCEMENT

When required, reinforcement shall be placed in the concrete work. Reinforcement deformation shall be performed as per ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement or latest edition. Reinforcement steel grades shall be billet intermediate or hard. Twisted Bars shall not be used, Fabric Reinforcement shall conform to the requirements of ASTM A1064

or latest edition that is relevant. Welded deformed steel wire fabric for Concrete reinforcement shall meet the requirements of AASHTO M 221 (ASTM A1064) or latest edition that is relevant. Welded wires shall be elevated with the use of chairs. Epoxy coated reinforcing Steel Bars shall meet ASTM A775/A77 requirements or latest edition.

303-1. BASIS OF PAYMENT

Reinforcement shall not be paid for separately. The cost of such work shall be included in the contract unit price for the item of work specified.

304. BACKFILL

304-1. MATERIALS AND GENERAL

Material for backfill other than under Gabion mattresses shall be carefully selected from the excavated material or from other sources as may be required by the Engineer. Such material shall be granular, free from any deleterious material including but not limited to clay, muck, organic matter or debris, contain no rocks or other hard fragments greater than three inches (3") in the largest dimension and all fill shall be similar material.

Material for backfill under Gabion mattresses shall be an A-1 soil meeting AASHTO M145 (latest edition).

Backfill shall be carried up evenly in layers not exceeding eight inches (8”) in thickness and shall be compacted into place by mechanical tamping to 98% before the next layer is applied. A hydro-hammer shall not be used for compaction. Backfill placed around pipes shall be carefully placed below the pipe haunch, around the sides, and top of pipe by hand shovels and thoroughly compacted to twelve inches (12") above the pipe by tamping or other suitable means.

For backfill in small areas that do not permit any type of tamping, Contractor may use flowable fill to achieve required density. Refer to *Section 306* for more details on flowable fill. Where wet conditions are such that dewatering by normal pumping methods would not be effective, as determined by the Engineer, Contractor may use #57 stone (meeting FDOT’s specifications) and hand tamping until backfill has reached an elevation and condition such as to make the use of the mechanical tampers practical. Fully wrap the stones with a layer of Type D filter fabric of *FDOT Index 199* (latest edition). Do not place stones within four feet (4’) of the ends of trench or ditch; use normally accepted backfill material at the ends.

Where new cast-in-place concrete work is performed, do not place backfill until the specified twenty-eight (28) days compressive strength occurs.

Heavy construction equipment shall not be permitted to cross over pipes or culverts until placing and compacting backfill material to the finished earthwork grade or to an elevation of at least four feet (4’) above the top of the pipe or culvert.

The cost of backfill, flowable fill, alternative approved material for wet conditions, and extra dewatering effort to achieve required density, etc., shall be included in the contract unit price or lump sum price for the item of the work specified.

304-2. TESTING AND INSPECTION

Contractor shall employ and pay for the services of an independent testing laboratory, approved by the Engineer, to perform density testing on backfilled material. All testing shall be witnessed by the Engineer’s Representative. The test shall be repeated until satisfactory results are obtained. The Contractor shall be charged for all retests and re-inspection services.

Backfill under all types of pavement areas shall be compacted in layers not to exceed 6" in thickness unless an alternate method is approved by the Engineer. Backfill shall be a minimum of 98% compaction as determined by AASHTO T 180 - Modified Proctor Density Test (latest edition) to the bottom of pavement.

Backfill outside of pavement areas shall be compacted to the full depth to the ground surface to a minimum of 95% compaction as determined by AASHTO T 180 - Modified Proctor Density Test (latest edition).

Backfill under buried structures shall be in accordance with these specifications to prevent future subsidence.

Backfill Testing: The Contractor shall demonstrate the adequacy of backfill compaction by performing density testing. For each test location, density testing shall be performed at six-inch (6") lifts. The character of the backfill material will be observed during the excavation for density testing to determine conformance with the specifications. Density testing shall be performed using nuclear field density equipment or conventional weight-volume methods. If the weight-volume method is used, volume shall be determined by using the sand replacement test (ASTM D1556/ D1556M the latest edition) or liquid displacement methods (ASTM D2167 latest edition). If nuclear methods are used, the trench correction effect shall be accounted for by recalibrating the nuclear gauge on its calibration block at the location of each test prior to taking the density measurement. The Contractor shall furnish all equipment, tools, and labor to prepare the test site for testing.

Normal Testing Frequency: One test shall be performed for each one hundred feet (100') of backfill or fraction thereof or for each single run of pipe/culvert connecting two (2) successive structures whichever is less. The location of the test within each section shall be selected by the Engineer's Representative. Testing shall progress as each one hundred-foot (100') section is completed. Four (4) tests equally spaced around each structure shall be performed on each six-inch (6") lift. Testing which indicates that unacceptable material has been incorporated into the backfill, or that insufficient compaction is being obtained shall be followed by expanded testing to determine the limits of the unacceptable backfill.

Expanded Testing Requirements: If normal testing within a testing section indicates unacceptable backfill, the Engineer's Representative may require additional testing within the same test section to determine the limits of unacceptable backfill. Additional testing required by the Engineer's Representative shall be paid for by the Contractor and shall not exceed testing of four (4) additional locations within the test section. Unacceptable backfill within the limits established by the testing shall be removed and replaced by the Contractor at no additional cost to the city. Additional testing beyond that required may be performed by the Contractor at his expense to further delineate limits of unacceptable backfill.

305. RIPRAP

The work included in this specification includes the construction of riprap as shown on the plans. The riprap shall be constructed per *Section 530* of *FDOT's Standard Specifications* (latest edition).

305-1. BASIS OF MEASUREMENT

The basis of measurement for riprap will be weight, in tons, in surface dry natural state. The scales must be calibrated and certified by an independent party and carry a state certification.

305-2. BASIS OF PAYMENT

The pay item for sand-cement riprap shall include: all materials, testing, labor, grout, hauling, equipment, excavation, backfill, dressing and shaping for placement of sand-cement and all incidentals necessary to complete the work.

The pay item for rubble riprap shall include: all materials, required bedding stone, dressing and shaping for placement of bedding stone, filter fabric, testing, hauling, excavating, backfill, dressing and shaping for placement of rubble, and all incidentals necessary to complete the work. No payment will be granted if concrete or stone that exists on-site is used as rubble riprap.

306. FLOWABLE FILL

Flowable fill is used in backfill and to fill all abandoned pipelines that are not removed. Mains that need to be abandoned shall be cut, capped, and filled with flowable fill meeting the requirements specified herein. Flowable fill shall adhere to Section 121 of FDOT specifications (latest edition).

The Contractor shall be responsible for producing a flowable mixture using these guidelines and adjusting his mixture design as called for by circumstances or as may be directed by the Engineer.

General mix requirements are as follows:

Components	Excavatable	Non Excavatable	Cellular Concrete
Cement (lb/yd^3)	75-100	75-150	Min 150
Supplementary Cementitious Materials (lb/yd^3)	None	150-600	
Fine Aggregate	*	*	*
Water	**	**	**
Air	5-35%	5-15%	***
Unit Weight (lb/ft^3)	90-110	100-125	20-80
28 Day Compressive Strength	****	****	****

* Fine aggregate shall be proportioned to yield 1 cubic yard (yd^3).

** Mix design shall produce a consistency that will result in a flowable self-leveling product at the time of placement

*** In cellular concrete, preformed foam shall be proportioned at the jobsite to yield 1 cubic yard in accordance with design requirements

**** The requirements for percent air, compressive strength, and unit weight are for laboratory designs only and are not intended for jobsite acceptance requirements

Weights for fine aggregate and water shall be adjusted according to cementitious content. The mix proportions shall be adjusted for removability, pumpability and flowability. If required, strength test data shall be provided prior to batching.

If required by the Engineer, the flowability can be measured by afflux time determined in accordance with ASTM C939/ C939M – 16a (latest edition) and shall be 30 seconds +/- 5 seconds as measured on mortar passing the No. 4 sieve. The equipment required to perform this test shall be provided by the Contractor.

The Contractor shall flush all raw sewage, sludge, debris, and water from the force mains prior to filling pipeline with flowable fill. If not discharged into a sanitary sewer system, the Contractor shall collect all flushing water and dispose of at a wastewater treatment facility. City Public Utilities Department IPP Coordinator and Director and/or Assistant Director must approve of the discharge into the collection system or wastewater treatment plant.

The Contractor must locate and verify all connections of the piping before filling the pipeline with flowable fill to avoid redirection and reconnection and report them to the Engineer. During placement of fill, compensate for irregularities in sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.

Clean placement areas of sewer and water lines of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Remove free water prior to starting fill placement.

All proposed new force mains shall be installed, pressure tested, and placed in-service prior to abandoning the existing force mains. All pipes shall be abandoned in a manner which results in the abandoned pipeline not being pressurized.

Flowable fill shall be produced and delivered using concrete construction equipment. Placing flowable fill shall be by chute, pumping or other methods approved by the Engineer.

The flowable fill shall be placed to the designated fill line without vibration or other means of compaction. Placement shall be avoided during inclement weather, e.g. rain or ambient temperatures below 40°F. The Contractor shall take all necessary precautions to prevent any damages caused by the hydraulic pressure of the fill during placement prior to hardening. Also, necessary means to confine the materials within the designated space shall be provided by the Contractor.

During placement of the fill, the Contractor is to avoid construction stoppage that would exceed the working time of the fill. If for any case that the fill would harden, the Contractor is responsible for properly installing fill into the abandoned pipeline from another location and shall meet the requirements specified herein.

A city Engineering Department Representative shall be present to witness the placement of flowable fill in abandoned pipelines. A 48-hour notice shall be given to the city before the placement of fill.

The flowable fill shall be proportioned and placed as specified herein. In general, the strength desired is the maximum hardness that can be excavated at a later date using conventional excavating equipment. No curing protection is required.

The fill shall be left undisturbed until material obtains sufficient strength. Sufficient strength is a minimum of 150 psi penetration resistance as measured using a handheld penetrometer. The penetrometer shall be provided by the Contractor.

All flowable fill areas subjected to traffic loads must have a durable riding surface.

Payment of the applicable lump sum price shall be full compensation for furnishing all labor, materials and equipment necessary and will include, but is not limited to the necessary costs associated with the installation of the flowable fill as shown in the Drawings and as described in the Contract Documents.

307. MATERIAL INDEPENDENT TESTING

The city shall have the right to have an independent testing laboratory select, test, and analyze, at the expense of the city, test specimens of any or all materials to be used. The results of such tests and analyses shall be considered, along with the tests or analyses made by the Contractor, to determine compliance with the applicable specifications for the materials so tested or analyzed. The Contractor hereby understands and accepts that wherever any portion of the work is discovered, as a result of such independent testing or investigation by the city, which fails to meet the requirements of the Contract documents, all costs of such independent inspection and investigation as well as all costs of removal, correction, reconstruction, or repair of any such work shall be borne solely by the Contractor.

400 SERIES: SANITARY SEWER

401. SANITARY MANHOLES

401-1. BUILT UP TYPE

Manholes shall be constructed of brick with cast iron frames and covers as shown on the drawings. Invert channels shall be constructed smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made in a smooth curve of as large a radius as possible. Changes in size and grade of channels shall be made gradually and evenly. Invert channels shall be formed by one of the following methods: formed directly into concrete manhole base, build up with brick and mortar, or lay half tile in concrete. For invert channels formed using the brick and mortar, or the half tile in concrete approaches the entire bench and channel area will be coated with a minimum of one-half inch of Xypex Megamix II or approved equal.

The manhole floor outside of channels shall be made smooth and sloped toward channels. Free drop in manholes from inlet pipe invert to top of floor outside the channels shall not exceed 12 inches (12”).

Standard Drop Manholes shall be constructed wherever free drop exceeds twelve inches (12”). Doghouse manholes and flat top manholes are not permitted. If a drop manhole is needed, only outside drop manholes allowed.

Manhole steps shall not be provided. Joints shall be completely filled with mortar, shall be smoothed from inside of manholes.

The entire interior and exterior of brick manholes shall be plastered with one half inch (1/2”) of Mega Mix II with Bio San as supplied by Xypex or approved equal.

Brick used may be solid only. Brick shall be laid radially with every sixth course being a stretcher course.

Maintenance of Flow Plan:

1. The Contractor shall prepare a Maintenance of Flow Plan that describes in detail the work that will be performed by the Contractor to maintain continuous operation of the city’s existing utility services. Maintenance of Flow Plan shall address the temporary and permanent flow diversion of gravity sewers and service laterals.
2. Temporary diversion of the gravity sewer flows shall be done using bypass pumps (one duty, one standby) to pump from the upstream manhole to the downstream manhole. Bypass pumps shall have hospital grade sound attenuation. The Contractor shall obtain peak wet weather flow rates in the gravity sewer from the city and shall demonstrate in the Maintenance of Flow Plan that adequate pumping capacity is provided to accommodate peak wet weather flow. The Contractor and city personnel that are experienced in the collection system shall determine the float levels in the field, pump on, standby or lag pump on, and high-level alarm. The high-level alarm shall be connected to an auto dialer to notify the Contractor of an alarm condition. The bypass pump suction manhole shall use the collection system for a temporary wet well storage; however, surcharging in the existing sewer system shall be limited. Once the high-level float alarm is triggered, it shall allow enough time for emergency Contractor personnel to arrive on scene and resolve the problem prior to any sanitary sewer overflows. The bypass suction and discharge pipes may require the removal of the manhole tops which will result in excess odor escaping from the manholes. The contractor shall provide a means to seal odors within the bypass manholes to minimize odors during the temporary diversion.
3. The Maintenance of Flow Plan shall include a sequence of construction with projected time, in days, for each step in the sequence.

4. If the work required to maintain utility operation must occur during evening, night or weekend hours, the Contractor shall notify the affected residents in advance of the projected work. The Contractor shall reimburse the city for overtime work, including inspector overtime, in excess of regular working hours. The Contractor must also get permission from city Project Manager before working outside of Noise Ordinance hours.
5. Identify the person(s) responsible for executing the Maintenance of Flow Plan and the systems to be put in place for monitoring the existing utility system's ability to maintain flow.

401-2. PRECAST TYPE

Precast Sanitary Manholes shall conform to this specification unless otherwise approved by the City Engineer.

AASHT0 M 85 Type II cement, with Xypex Admix C-1000R or approved equal, shall be used throughout with a minimum wall thickness of five inches (5"). The precast sections shall conform to ASTM C478 (latest edition). Section joints shall be a tongue and groove with "ram neck" gasket, Pro Stik Butyl Sealant or "O" ring to provide a watertight joint. Caulking of joint shall not be allowed. Minimum concrete strength shall be 4000 psi at 28 days. Xypex admixture must be added to the concrete at the time of batching. Under normal conditions, the crystalline powder shall be added to the concrete mix at the following rates:

1. Xypex Admix C-1000R 3.5 % by weight of cement content

Note: For enhanced chemical protection or for meeting specific project requirements or where the concrete mix design contains higher than 25% type F fly ash content or includes a Portland cement/slag cement/type C fly ash blend, consult with manufacturer or its authorized representative to determine appropriate dosage rates.

One set of shop drawings and location inventory shall be submitted to the city Project Manager and Engineer of Record for approval. Approval of shop drawings does not relieve Contractor of responsibility for compliance to these specifications unless letter from Contractor requesting specific variance is approved by the City Engineer.

Location inventory submitted with shop drawing shall detail parts of manhole per manhole as numbered on the construction plans. All manhole parts shall be numbered or lettered before being sent to the job site to permit proper construction placement. A plan or list of the numbering system shall be present on the job site when manhole components are delivered. Precast manhole dimensions, drop entry, grout flow of channel, etc., shall be as shown on city of *Clearwater Engineering Index 302 Sheets*.

Manhole sections shall be rejected if abused during shipping or placement and if pipe openings are not properly aligned. The "break in" to precast manholes for pipe entry will not be allowed. The manhole base shall be set on a pad of A 1 or A 2 Classification compacted soil approximately five inches (5") thick as referenced in *Section 304-2* and twelve inches (12") of # 57 grade stone, wrapped in geotextile to secure proper seating and bearing. Refer to these Technical Specifications, *Section 304* for backfill and compaction requirements.

401-2.1. MANHOLE ADJUSTMENT RINGS (GRADE RINGS)

Between the top of the manhole cone/corbel and the manhole cover frame, a manhole adjustment ring shall be installed. The intent of the manhole adjustment ring is to accommodate future grade changes without disturbing the manhole. See *Section IV, Section 703-7, Asphaltic Concrete – Adjustment of Manholes*. All final grade adjustment of manhole covers, and frame assemblies shall be completed utilizing injection molded high density polyethylene (HDPE) adjustment rings as manufactured by LADTECH, Inc. or an approved equal. The adjustment rings shall be manufactured from polyethylene plastic as identified in ASTM Specification D4976 (Standard Specification for Polyethylene Plastic Molding and Extrusion

Materials) the latest edition. Material properties shall be tested and qualified for usage per the ASTM Test Methods referenced in the above ASTM standard. The adjustment rings shall be molded from 100% recycled material. The plastic rings shall be manufactured utilizing the injection molding process as defined by SPE (Society of Plastic Engineers). The adjustment rings shall be tested to assure compliance with impact and loading requirements per the AASHTO Standard Specification for Highway Bridges latest edition. Installation shall be per manufacture's recommendations for vacuum test installations only. The annular space between the rings and cone basin, the rings, and the rings and cover frame shall be sealed utilizing an approved butyl rope (not caulk) sealant. All adjustment for matching road grade shall be made utilizing a molded and indexed slope ring. All grade rings shall be covered by the LADTECH, Inc. warranty or one of equal terms and duration. Grade rings shall be Traffic Rated AASHTO HS-20 (latest edition).

401-2.2. STAINLESS STEEL MANHOLE STORM WATER INFLOW ABATEMENT INSERTS (DISH/PAN)

401-2.2.1. MATERIALS AND DESIGN

General: The insert, gasket and relief valve shall be manufactured of materials resistant to corrosion from atmospheres containing hydrogen sulfide and dilute sulfuric acid.

Insert: The insert body shall be manufactured of 304 stainless steel with a thickness of not less than 18 gauge. The insert shall have straight sides designed to allow a loose fit into the ring for easy removal. The insert manufacturer must furnish a "load test verification" showing a load test failure in excess of 3000 lbs. For added strength, no less than three (3) ribs shall be stamped in bottom of the insert.

Gasket: The gasket shall be extruded onto the stainless dish with a Synthetic elastomer having the following physical properties:

Tensile Strength: 335 psi - ASTM D412 Elongation 400-600% - ASTM D412 Shore Hardness: 25 Shore A - ASTM D2240 Adhesion to Stainless: 580 psi - ASTM D454 l/D7234 (Use latest edition)

Relief Valve: The gas relief valve shall be designed to release at a pressure of .5 to 1.5 PSI and have a water leak down rate no greater than 5 gallons per 24 hours. The valve shall be installed in the insert by means of a hole tapped in the insert by the manufacturer. The valve shall be made of nitrite for prevention of corrosion from contact with hydrogen sulfide, dilute sulfuric acid and other gases associated with waste-water collections systems.

Handle: The dish shall have a handle of 3/16" plastic-coated stainless-steel cable installed on the body of the dish. The handle shall be attached with a #6 high-grade stainless-steel rivet. The cable shall be braided in a manner which resists cutting with common bolt cutters. The cable terminal and eye shall be stainless steel.

Manhole Frames: Manhole frame sizes vary, and the city will provide the successful bidder with specific dimensions and number of required inserts for each manhole frame size. Maximum insert outside diameter (OD) will not exceed 26.5 inches nor be less than 23 inches. Most frames have an outside diameter of 23.5 inches with a clear opening of 21.5 inches.

401-2.2.2. MEASUREMENT AND PAYMENT

Payment of each inflow abatement insert shall be full compensation for furnishing all labor, materials and equipment necessary but not limited to the costs associated for the installation of the sanitary manholes' pans/dishes.

401-3. DROP MANHOLES

Standard drop inlets to manholes shall be constructed of commercial pipe, fittings, and specials as detailed on the drawings. Only outside drop manholes allowed.

401-4. FRAMES AND COVERS

Manhole frames and covers shall be set in a full bed of mortar with the top of the cover flush with or higher than finished grade as directed. Refer to *Clearwater Standard Detail Index 301*.

401-5. MANHOLE COATINGS

The exterior of all precast manholes shall not require any specific coating. The interior shall be coated with either Spraywall®, Polyurethane or Raven 405 Epoxy at the direction of the city at a thickness not less than 125 mil. For new manholes install geotextile wrap at the joints.

401-6. CONNECTIONS TO MANHOLES

Connections to existing sanitary manholes using approved PVC sewer main shall be made with a manhole adapter coupling by NPC Kor-N-Seal® with stainless steel bands or approved equal water stop coupling.

401-7. MEASUREMENT AND PAYMENT

Payment of each inflow abatement insert shall be full compensation for furnishing all labor, materials, and equipment necessary but not limited to the costs associated for the installation of the sanitary manholes.

402. RAISING OR LOWERING OF SANITARY SEWER STRUCTURES

Sanitary Sewer Structures shall be raised or lowered as indicated on the plans or as indicated by the Engineer.

402-1. BASIS OF PAYMENT

Payment, unless covered by a bid item, shall be included in the cost of the work.

403. SANITARY SEWERS AND FORCE MAINS

403-1. MATERIALS

403-1.1. GRAVITY SEWER PIPE

GRAVITY SEWER PIPE SHALL BE POLYVINYL CHLORIDE OR DUCTILE IRON. All polyvinyl chloride mains (pipe and fittings) shall be at least 6-inch-diameter, SDR 26, and conform to ASTM D3034; laterals can be four-inch (4'') PVC schedule 40. Pipe and fittings shall be plainly marked with the ASTM designation. Strong back stainless steel Fernco is required for all non-mechanical PVC connections. The bell end of joints and fittings shall have a rubber sealing ring to provide a tight flexible seal in conformance with ASTM D3212 (latest edition). The laying length of pipe joints shall be a maximum of twenty feet (20').

Unless otherwise noted in these specifications or the construction plans, ductile iron pipe and fittings for gravity sewer shall conform to *Section 502-2.1.* of these Technical Specifications for DIP water main except the pipe interior shall be lined with Protecto 401 ceramic epoxy in accordance with manufacturer's recommendations. Where sanitary sewer main is to be placed between buildings lots in a sideline easement, the sewer main shall, insofar as possible, be constructed without manholes or lateral connections within the side easement. A two-way cleanout shall be installed on each lateral at the property line.

403-1.2. FORCE MAIN PIPE

FORCE MAIN PIPE SHALL BE POLYVINYL CHLORIDE, DUCTILE IRON OR HDPE. Unless otherwise noted in the specifications or construction plans, polyvinyl chloride, ductile iron and HDPE force main pipe and fittings shall conform to *Section 502-2.1* and *502-2.2* of these Technical Specifications for water main pipe except that DIP shall be lined with Protecto 401 ceramic epoxy in accordance with manufacturer's recommendations. All polyvinyl chloride pipe which has become deteriorated due to exposure to ultraviolet radiation shall be rejected.

403-2. INSTALLATION

403-2.1. GRAVITY SEWER PIPE

Installation of Thermoplastic gravity sewer pipe shall be in conformance with recommended practices contained in ASTM D2321 (latest edition).

The bottom trench width in an unsupported trench shall be limited to the minimum practicable width (typically pipe OD plus eight inches (8") to twelve inches (12") on each side) allowing working space to place and compact the haunching material. The use of trench boxes and movable sheeting shall be performed in such a manner that removal, backfill and compaction will not disturb compacted haunching material or pipe alignment.

Dewatering of the trench bottom shall be accomplished using adequate means to allow preparation of bedding, placement of the haunching material and placement of the pipe in the trench without standing water. Dewatering shall continue until sufficient backfill is placed above the pipe to prevent flotation or misalignment.

Where pipe bedding is insufficient to adequately support the pipe, the Contractor will be required to remove unsuitable material and pipe bedding and replace with Class I material (one half inch (1/2") diameter aggregate) to provide firm support of the pipe.

The laterals shown on the plans do not necessarily reflect exact locations. The Contractor is required to locate all existing laterals for reconnection and to coordinate with the construction inspector, the location of all new laterals.

403-2.2. FORCE MAIN PIPE

Installation of force main pipe shall be in conformance with *Section 503* of these Technical Specifications for water main pipe.

403-3. INSPECTIONS OF LINES AND MANHOLES

A. Inspection of completed lines and manholes shall be scheduled within a reasonable time after construction or when required by the Engineer. Before scheduling an inspection, the Contractor shall prepare the lines by cleaning and flushing. Manholes shall be clean, finished, and free of leaks.
B. Manholes shall be on a true and uniform grade. The inverts shall have a smooth steel troweled finish. All benches shall be uniformly sloping. The frames shall be tight and properly set in mortar

on solid masonry. The invert, benches and adjacent pipe shall be free of splattered mortar. All required interior lining or paint shall be kept intact. Manhole frames shall be adjusted to grade with the covers and frames cleaned and free of mortar and asphaltic mixtures. All precast manhole seams shall be filled with an approved asphaltic compound.

C. Pipe between manholes shall be true to line and grade. Dips and sags with one inch or more of trapped water shall be cause for rejection. Air testing may be required also at the Contractor's expense. Contractor shall provide personnel to assist with inspections.

D. The Contractor shall provide city Public Utilities Department and the Engineer with a Television Inspection of the completed gravity sewers in accordance with the following:

1. Shall be performed by a National Association of Sewer Service Companies (NASSCO) Pipeline Assessment & Certification Program (PACP) Certified Operator who will use software that is compatible with CUES Granite products latest version software to NASSCO PACP Standards.
2. Shall be submitted as digital media that includes video and data base file in PACP format and include a printed copy of the PACP television inspection log.
3. Shall perform a manhole inspection and provide a completed NASSCO Manhole Inspection form (latest version) for each manhole that is inspected
4. All pertinent data recorded in audio on the media to include:
    a. Subdivision name and phase number.
    b. Manhole numbers (these numbers must match manhole numbers on “as built” and record drawings).
    c. Date of inspection
    d. Size and material of pipe
    e. Service connection locations, right or left
    f. All distances between manholes
    g. Locations of suspected and obvious pipe deficiencies (i.e., bad joints, breaks or leaks, etc.)
5. PVC pipe shall have a deflection test using a seven and one-half percent (go-no-go) test mandrel of appropriate size, which shall be visible on video at all times.
6. The printed NASSCO PACP television report (indicating manhole numbers) which will accompany the media. This written report must include:
    a. Manhole numbers (these numbers must match manhole numbers on "as-built" and record drawings).
    b. Service connection locations, right or left.
    c. Reference to service connection locations out of manholes.
    d. Locations of suspected and obvious pipe deficiencies (i.e., bad joints, breaks or leaks, etc.).
    e. Depth of each manhole.
    f. Actual measured distance (on ground) between manholes.
7. All visual and television inspections shall be completed by the contractor and approved by city Public Utilities Department and Engineer after the road base has been constructed but prior to the placing of any asphalt.
8. Television Inspection Media must clearly show details of structural defects, misalignments and infiltration.

403-4. TESTING

403-4.1. TESTING OF GRAVITY SEWERS

The Contractor shall take all precautions to secure a perfectly watertight sewer under all conditions. The water tightness of a sewer which has a crown lying below groundwater level shall be tested by measuring infiltration. The water tightness of sewers having crowns lying above groundwater level shall be tested by filling the pipe with water so as to produce a hydrostatic head of two feet or more above the crown of the sewer at the upper end of the test section or the water table outside of the sewer, whichever is higher, and then measuring the exfiltration. In no case shall the infiltration or exfiltration exceed fifty (50) gallons per inch of diameter per mile per day. The Contractor shall furnish all labor, materials and equipment to test the amount of infiltration or exfiltration under the Engineer's direction. Where the infiltration or exfiltration is excessive, the Contractor at their own expense shall take the necessary steps to remedy such conditions by uncovering the sewer, remaking the joints or by replacing the entire length of sewer as required by the Engineer. No such repaired joints may be backfilled until after they have been tested and found to be acceptable. Care shall be taken to avoid flotation. The Contractor shall TV inspect all mains and provide to the Engineer to verify the true and uniform grade and the absence of bellies or dropped joints prior to acceptance. Any dips or sags of more than five percent (5%) of the pipe inside diameter (ID) dimension from its design alignment shall be cause for rejection. The above tests shall be performed at the discretion of the Engineer on any or all sections of the line.

403-4.2. TESTING OF FORCE MAINS

Force mains shall be tested under a hydrostatic pressure of 150 psi for two (2) hours, as described in Section 504 of these Technical Specifications for the testing of water mains.

403-5. BASIS OF PAYMENT

403-5.1. GRAVITY SEWER PIPE

Payment for in place sanitary sewer gravity main pipe shall be the unit price per linear foot per appropriate range of depth of cut as contained in the contract bid. Measurement for payment shall be along the centerline of the sewer main from center to center of manholes. Payment for laterals shall be the unit price per linear foot of pipe as measured from the centerline of the sewer main pipe to the terminal end of the lateral pipe including a two-way cleanout at the property line.

Payment for sewer pipe shall include all labor, equipment, and materials necessary to complete the installation. This shall include clearing and grubbing, excavation, shoring and dewatering, backfill and grading.

403-5.2. FORCE MAIN PIPE PAYMENT

Payment and measurement of force main pipe shall be the same as described in *Section 506* of these Technical Specifications for water main pipe.

404. CURED-IN-PLACE PIPE SANITARY SEWER REHABILITATION

404-1. GENERAL

It is the intention of this specification to provide for the trenchless restoration of sanitary sewers, mains and service laterals, by the installation and curing of a resin impregnated felt tube/cured-in-place pipe (CIPP) liner. The liner shall be jointless, continuous from manhole to manhole, watertight and chemically resistant to withstand exposure to domestic sewage. Installation and curing shall include all labor, materials and equipment to provide for a complete, fully restored and functioning installation. Any proposed installer/contractor, or liner system, must be pre-approved by the city prior to receiving bids.

The installer must be certified by the liner system manufacturer for installation of the liner system. The city reserves full and complete authority to approve the satisfactory nature of the both the liner system and the installer.

The contractor shall provide trenchless reconstruction of service laterals and mainline sewers. The contractor shall have the capability of performing city's selected services which include televised inspection, data collection, system flow analysis, and pipeline reconstruction.

The contractor shall employ adequate staff to perform the services required, staff should include Project Representative, Project Manager, Field Supervisor and Senior Foreman. Field supervisory personnel employed by the CIPP Contractor will have at least five (5) years of experience in the performance of the work and tasks as stated in the Contract Documents.

Staff shall be proficient and experienced in all phases of services mentioned.

The contractor shall perform all work and shall be a licensed Contractor for these services.

The contractor shall be certified in confined space entry (OSHA) and traffic control.

The contractor shall provide services that include safety measures for both the public and workers, including traffic control, and shall coordinate all scheduling with the city.

The contractor shall work with the city in establishing priorities and in preparing work assignments.

The contractor shall be completely responsible for the control of the environment of the work site during on-site operations. All precautions shall be taken by the selected contractor to protect the workers, public and city staff from the exposure to harmful or hazardous substances with the sewer system.

The contractor shall be responsible for the transport and disposal of all waste materials. The selected contractor shall be responsible for all waste material spills and clean-up in the loading, hauling, and unloading of the contractor's equipment.

The contractor shall be responsible for conforming to any and all requirements regarding hauling and disposal of sewer wastes from each city's work site in accordance with OSHA regulations and those that may be mandated by the Federal of State Governments. The contractor shall ensure that all waste material transporters possess all required local, state and federal transportation permits and that they comply with all local, state and federal regulations, including but without limitation, 40 CFR Part 263, "Standards Applicable to Transporters of Hazardous Wastes" and Chapter 17-730, Part 3, Florida Administrative Code, as may be amended from time to time.

The contractor shall inform the city of its planned work schedules and shall afford the city reasonable opportunity to observe and inspect the contractor's work in process. The city will be advised of all schedule changes and notified when a work site is left for a 24-hour period when work is not complete.

The contractor shall report to city's Inspector their daily progress.

Work hours shall be from 7:00 AM to 3:30 PM Monday through Friday unless authorized in writing by the city's Project Manager.

404-2. MEASUREMENT & PAYMENT

Payment for sanitary sewer rehabilitation using the cured-in-place product shall be made per linear foot including all preparation, installation, curing, flow maintenance, lateral reconnection, submittals, light cleaning (3 passes of cleaning head) of piping, material removal & disposal, CCTV inspection/reporting (pre & post installation) sealing of all leaks, connection to all manholes, traffic control on city streets, testing such as infiltration and/or exfiltration, provision of equipment, labor, materials, operations, restoration, etc., to provide a fully completed and operational sewer.

Payment shall be measured from center of manhole to center of manhole for the sanitary sewer mains and from the connection to the main to the terminus of the liner for service laterals.

404-3. SUBMITTALS

The Contractor shall submit the following information:

1. Manufacturer's certification that the materials to be used meet the referenced standards and these specifications.
2. License or certificate verifying Manufacture's/Licensor's approval of the installer.
3. Proposed equipment and procedures for accomplishing the work.
4. Lining Manufacturer's product data and instructions for resin and catalyst system.
5. Design Calculations, in accordance with the Appendix of ASTM F1216 or latest edition, for each length of liner to be installed including the thickness of each proposed CIPP. It will be acceptable for the Contractor to submit a design for the most severe line condition and apply that design to all of the line sections. To be completed and certified by a Professional Engineer proficient in the design of pipeline systems. All calculations shall include data that conforms to the requirements of these specifications.
6. A detailed installation plan describing all preparation work, cleaning operation, pre-closed-circuit television (CCTV) inspections, flow maintenance, traffic control, installation procedure, method of curing, service reconnection, quality control, testing to be performed, final CCTV inspection, and all else necessary and appropriate for a complete CIPP liner installation.
7. Tube wet-out and cure method including: a complete description of the proposed wet-out procedure, manufacturer's recommended cure method- for each diameter and thickness of CIPP liner to be installed, and detailed curing procedure detailing the curing medium and the method of application.
8. A detailed installation schedules.
9. All SDS sheets for all materials to be furnished for the project.
10. Weekly work schedules shall be submitted no later than close of business on proceeding Thursdays for the work on the following week. Scope of the schedule shall include the following: cleaning operations, CCTV pre & post operations, lining, and crew leader's information including phone number.

404-4. CURED-IN-PLACE PIPE (CIPP) FOR GRAVITY SEWER MAINS

404-4.1. LINER MATERIAL

The liner material shall be an epoxy, vinyl ester or polyester fiber felt resin-impregnated tubing or city Engineering Department approved equal, sized to tightly fit the internal circumference and length of the designated gravity sewer. The cured liner shall meet the minimum initial structural properties as listed in ASTM F1216. The liner shall be designed in accordance with the Appendices in ASTM F1216. It shall be assumed that a fully deteriorated gravity sewer pipeline having no structural strength will be rehabilitated with H-20 traffic loading, the water table's at the ground surface and the product installed will have a minimum expected lifetime of fifty (50) years. In no case shall the liner thickness be less than six millimeters (6 mm) for pipe sizes six inches (6'') through eight inches (8'') and 7.5 millimeters for pipe sizes ten inches (10'') through twelve inches (12'') in diameter. Minimum liner thickness for pipes greater than twelve inches (12'') shall be as specified by the city. Liner shall be sized by Contractor to provide a tight fit to the inside circumference of the host pipe and shall be a continuous jointless lining from manhole to manhole.

Unless otherwise specified, the Contractor shall use an epoxy vinyl ester or polyester resin and catalyst system, and a fiber felt tube compatible with the inversion or other approved alternate installation process and having the following minimum physical properties for the cured pipe:

PROPERTY VALUE	TEST METHOD	MINIMUM (psi)
Tensile Strength	ASTM D638 or latest edition	3,000
Flexural Strength	Modified ASTM D790 or latest edition	4,500
Flexural Modulus of Elasticity	Modified ASTM D790	250,000
Long-Term (50 year) Modulus of Elasticity	ASTM D7790 or latest edition	125,000

The epoxy vinyl ester or polyester resin and fiber felt tubing system shall be in accordance with the requirements of ASTM F1216 and be fabricated to a size that, when installed, will neatly fit the interior of the host pipe. Allowance shall be made for circumferential stretching during a direct (non-inversion) pull in. The CIPP product shall fit tightly to the host sewer pipe (with minimal shrinkage) in such a way as to minimize water migration (tracking) between the liner and the host pipe. A vacuum impregnation process shall be used in conjunction with a roller system to achieve a uniform distribution of the resin throughout the tube under controlled conditions. The volume shall be adjusted by adding five to ten (10) percent excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into cracks or joints in the host pipe.

The outside of the fabric tube shall be marked every 5 feet with the name of the manufacturer or CIPP system, manufacturing lot and production footage.

404-4.2. CHEMICAL JOINT, CRACK AND ANNULAR SPACE SEALING MATERIALS FOR ACTIVE LEAKS AND SERVICE LATERAL CONNECTIONS

Chemical joint and crack sealing materials shall have the following properties:

1. React quickly to form a permanent watertight seal
2. Resultant seal shall be flexible and immune to the effects of wet/dry cycles
3. Non-biodegradable and immune to the effects of acids, alkalis, and organics in sewage
4. Component packaging and mixing compatible with field conditions and worker safety

5. Extraneous sealant left inside pipe shall be readily removable; and shall be compatible with the repair resin utilized.

Chemical joint sealing material shall be acrylic resin type and shall be furnished with activators, initiators, inhibitors, and any other materials recommended by the manufacturer for a complete grout system. Sealing grout shall be furnished in liquid form in standard manufacturer's containers.

404-4.3. MANHOLE CONNECTIONS

A seal, consisting of a resin mixture or hydrophilic seal compatible with the installed CIPP shall be applied at manhole walls in accordance with the CIPP System manufacturer's recommendation. Cost associated with manhole seals shall be included in the contract price of CIPP installation.

404-4.4. INSTALLATION AND EXECUTION

404-4.4.1. CLEANING/SURFACE PREPARATION

It shall be the responsibility of the Contractor to clean and prepare the existing pipes for rehabilitation. The Contractor shall perform light cleaning (3 passes of the jet head) using a jetting system capable of providing 60 gallons of flow at 3,000 psi. After light cleaning has been completed the Contractor shall attempt a pre-installation CCTV inspection. If the Contractor believes that the piping requires additional cleaning the collected CCTV video will be provided to the Inspector before beginning any heavy cleaning of the piping. Light cleaning is included in the cost of liner installation and heavy cleaning will be measured as a separate pay item. The Contractor will thoroughly clean the interior of the sewers to produce a clean interior surface free of all coatings, sand, rock, roots, sludge, or other deleterious materials prior to liner insertion. Flow maintenance will be provided by the Contractor as required. Bypass operations are to be so arranged as to cause minimum disruptions to local traffic, residents and commercial facilities. During the cleaning and preparation operations all necessary precautions shall be taken to protect the public, all property and the sanitary sewer facilities from damage.

All material removed from the sewers shall be the Contractor's responsibility for prompt disposal in accordance with all regulatory agency requirements. The Contractor may be required to control the rate of sewer cleaning in the sanitary system to avoid heavy pollution loads at the city's treatment plants.

404-4.4.2. TELEVISION INSPECTION

After cleaning, and again after the rehabilitation work on each section of pipe is completed, all pipe sections shall be visually inspected with a digital CCTV camera and recorded in DVD format. Cost of CCTV inspections is included in the cost of pipe lining CCTV data shall be provided to the city designated Project Manager. Asset Management (OWAM) software. This section describes the requirements of the Contractor in providing the following minimum requirements for video capture, photo capture and database structure to the city. The city is currently using CUES Granite video and data collection software. The Contractor shall provide the TV Inspections in the same CUES Granite product database, photo, and video capture format. The Contractor-provided TV inspections, database, DVDs, photos, and related files shall have the ability to direct synchronize to the city's existing CUES Granite product database.

404-4.4.2.1. IMAGE (PHOTOS) CAPTURE FORMAT AND REQUIREMENTS

The Inspection image files (pictures) shall have the ability to export to industry standard formats to include JPEG, BMP, and TIFF formats and be transferable by disk, thumb drive, DVD and/or external hard drive to an external personal computer utilizing standard viewers and printers.

404-4.4.2.2. DIGITAL VIDEO FORMAT AND REQUIREMENTS

Digital video files (Inspection Videos) shall be captured and/or recorded in the MPEG format or as specified by the city. The video capture files shall be in MPEG format with data linking (Inspection Observations) to the database file(s). The "Link" of the video capture file to the database observation file is required. The inspection observation(s) shall link to the video record in real-time.

The accompanying database shall support the following code system: PACP, or current code system being utilized by the city. The Database and Software program (CUES Granite products) shall be able to import asset data from an Esri ArcGIS (v.10.1+) geodatabase utilizing the network features to associate Sewer Mains with corresponding Sewer Nodes.

The database structure shall retain information on the various structures found within a sewer or storm system. It is important that the structures, nodes, manholes and pipe identifiers and related attribute information be retained as separate tables from the inspection allowing import of existing data from multiple sources. The data structure allows different projects to reside within a single database. Information gathered in projects shall be available to view by project or by system. Data gathered during project inspection shall be available to view by the selected structure. Therefore, all inspections can be viewed on a structure even if gathered in different projects.

404-4.4.2.3. SYNCHRONIZATION

The database shall have the ability to synchronize assets and inspections from replicated databases. The synchronization process should have built-in error checking for duplicates, updates and any modifications to the data being synched. This allows for multiple sources of data to be effectively consolidated into a single unitary database for analysis and evaluation.

404-4.4.3. LINER INSTALLATION

Liner shall be sized to field measurements obtained by the Contractor to provide a tight fit to the full interior circumference of the existing sanitary sewer and shall be a continuous, joint-less liner product from inside of manhole to inside of manhole. Contractor shall use installation methods approved by the liner manufacturer including liner placement, reforming to fit existing pipe, pressure and heat requirements and reconnection of laterals. The Contractor shall immediately notify the city of any construction delays taking place during the insertion operation. Contractor shall provide flow maintenance measures as described by the approved Flow Maintenance Plan. Flow Maintenance Plan shall be approved by the city Project Manager prior to 48-hours of mobilization. Flow Maintenance Plan shall include redundancy. Liner entries at manholes shall be smooth, free of irregularities, and watertight. No pinholes, tears, cracks, thin spots, or other defects in the liner shall be permitted. Such defects shall be removed and replaced by the Contractor at their expense. OSHA requirements for installation procedures, in particular, confined spaces are to be met.

404-4.4.4. LATERAL RECONNECTION

Sanitary laterals shall be reconnected as soon as possible to renew service. Laterals are to be reconnected by means of robotics, by internally cutting out the liner to 100% of the area of the original opening. All lateral reconnections are to be grouted, as directed by the city to prevent leakage. Grouting method and material is to be approved by the city. Cost for robotic reconnection shall be included in the cost to install the liner. If the city wishes to reconnect service lateral using a different method the cost to do so will be measured and paid for separately.

Any reconnections to laterals and connections to manholes which are observed to leak shall be resealed by the Contractor. All laterals discovered during the lining process are to be reconnected unless specifically directed otherwise by the city. Contractor shall notify all local system users when the sanitary system will not be available for normal usage by the delivery of door hangers seven days before commencement with

appropriate information regarding the construction project. Contractor shall notify the Senior Public Information Coordinator from the city Public Communications Department prior to distribution.

404-4.4.5. TIME OF CONSTRUCTION

Construction schedules will be submitted by the Contractor and approved by the city. At no time will any sanitary sewer service connection remain inoperative for more than an eight (8) hour period without a service bypass being operated by the Contractor. In the event that sewage backup occurs and enters buildings, the Contractor shall be responsible for cleanup, repair and property damage costs and claims.

404-4.4.6. TESTING AND ACCEPTANCE

Post cleaning and television inspection shall proceed only after all necessary work and preparation has been completed, including the following:

- Placement of traffic control measures in accordance with these specifications
- Implementation of adequate flow control
- Pre-installation cleaning and television inspection
- Installation of CIPP liner in accordance with specifications
- All services re-instated including grout sealing in accordance with these specifications

The Contractor shall clean and televise the assigned gravity sewer in accordance with *Sections 404-4.4.1, 404-4.4.2, 404-4.4.2.1, 404-4.4.2.2 and 404-4.4.2.3.* The interior surface of the pipeline shall be cleaned with high pressure water jet equipment immediately prior to conducting the post television inspection. Jetting equipment will provide a minimum of sixty (60) gallons per minute of water at 3,000 psi. All service locations, gouges, cracks, bumps, bulges and obstructions, such as dropped joints, shall be noted on the inspection. In the case of bellies in the line, the pipe shall be cleared of any standing water to provide continuous visibility during the post inspection. The Contractor shall provide all inspections in digital PACP format including printed inspection logs to the city. Cost associated with post-televising and cleaning shall be included in the contract price of CIPP installation.

The finished liner shall be free of significant visual defects, damage, deflection, holes, leaks and other defects.

Each individual pipe segment contained in a development is to be considered an “individual project” such that all work, including all deliverables shall be reviewed and accepted prior to the city accepting and processing payment for that individual project. No partial payments will be made on individual sewer projects.

404-4.4.7. CLEANUP

Cleanup is an essential part of the work. As the work progresses and is completed, the Contractor shall clean the various sites of all operations and completely restore all work areas to the satisfaction of the city. This cleanup shall be done as promptly as practicable and shall not be left until the end of the construction period. No part of the work shall be considered complete and no payment will be made until cleanup is completed.

404-5. CURED-IN-PLACE PIPE (CIPP) FOR SERVICE LATERALS

404-5.1. LINER MATERIAL

The lining material shall be a fiberglass/polyester needle fleece vacuum epoxy resin -impregnated or equivalent material tube, matching the diameter of the lateral pipe, which is inserted into the service lateral to be rehabilitated and cured-in-place by an acceptable curing method. No Polyester resins will be accepted.

The epoxy shall be suitable for the design conditions as well as the curing process. The cured liner shall provide a service life of 50 years and shall have the minimum structural properties listed below:

PROPERTY VALUE	TEST METHOD	MINIMUM (psi)
Tensile Strength	ASTM D638	3,000
Flexural Strength	Modified ASTM D790	4,500
Modulus of Elasticity	ASTM D790	250,000

The liner system shall consist of a sectional liner in the mainline (full wrap around the circumference of the main line extending 5" on either side of the service) and the continuous lateral liner shall have the capacity to extend to within 10 feet of the building foundation. The liner shall form a continuous, one-piece, tight fitting, corrosion resistant and verifiable non-leaking cured in place pipe. The one-piece section liner shall be manufactured in a factory setting prior to its arrival on site. No component of the liner (i.e. lateral tube to mainline piece) shall be glued or sewn fused in the field prior to installation. The material shall be capable of conforming to offset joints, bells, and disfigured pipe sections.

The liner shall be designed, fabricated, and installed for the actual conditions encountered for this application including the material of the host pipe, in accordance with the applicable provisions of ASTM F1216(latest edition), and shall meet the following minimum design conditions: AASHTO H-20 live load with one truck passing; Soil Weight 120 pounds per cubic foot. Coefficient of friction Ku'=0.130; Groundwater: At the ground surface; fully deteriorated pipe with 2 percent (min.) ovality. If ovality of existing pipe is found to be worse, use actual percent up to 5 percent (max.); Soil Modulus 1,000 psi; Factor of Safety = 2; Soil Depth: Depth of Cover will be determined by field measurements.

The liner shall be designed to withstand all imposed loads, including live loads and, if applicable hydrostatic pressure. The liner shall have sufficient wall thickness to withstand all anticipated external pressures and loads that may be imposed after installation. The design shall be performed and certified by a professional engineer licensed by the Florida.

The liner and resin shall be manufactured by Trelleborg Pipe Seals, BLD, Inc., LMK, Inc., or approved equal. The finished liner product shall be chemically resistant to domestic sewage over the expected lifetime of the rehabilitated pipe.

The lateral liner system shall create epoxy resin migration into the defect/joints of the existing lateral. A combination of mechanical and chemical bonding shall be created between the lateral lining system and existing host pipe.

404-5.2. EPOXY RESIN MATERIAL

The epoxy system shall meet the requirements of ASTM F1216 (latest edition), Section 5.2. The epoxy installed liner system shall produce a liner that will comply with the structural requirements specified herein and shall provide chemical resistance for the flow media in the gravity pipe. The epoxy shall be compatible with the rehabilitation process, shall be able to cure in the presence or absence of water, and shall have an initiation temperature for cure as recommended by the epoxy manufacturer. Polyester and Vinylester resins contain styrene and volatile organic compounds which are susceptible to shrinkage and UV Curing will not be accepted.

Submitted documentation from the epoxy manufacturer specifically describing the chemical characteristics of the epoxy system, including allowable mixing, impregnation, and handling time, transportation and storage time, and recommended curing cycle including temperatures, pressures, and times. The epoxy manufacturer's documentation must also include maximum allowable time for handling the impregnated tube prior to insertion and the maximum allowable elapsed time from insertion to exotherm. If remedial measures are available to extend either of the maximum allowable times indicated above, without affecting the physical properties of the epoxy, the epoxy manufacturer should describe these measures and the time limits beyond which even these measures will not prevent alteration of the physical properties of the epoxy.

404-5.3. INSTALLATION AND EXECUTION

The Contractor, when required, shall provide for the flow of sewage around the section(s) of main pipe where the service lateral designated for lining is located. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow. Contractor must coordinate installation with property owner(s).

Delivery, storage, and handling of approved products are the responsibility of the Contractor. The Contractor shall keep them safe from damage and stored with the proper environmental containment as outlined by the manufacturer. No products should be used that have exceeded the designated shelf life as outlined by the manufacturer. Remove damaged products from site. Promptly replace damaged products with new products at no additional cost to the city.

If the service lateral lining process requires the installation of a cleanout, the city must approve the work before it is done.

404-5.3.1. PRE-LINING INSPECTION

Prior to inspecting each service lateral the piping will be cleaned to allow passage of the camera. A recorded CCTV video survey must be completed on the sewer main and service laterals with a pan and tilt camera. The inspection shall confirm the location and clock reference of the lateral junctions to be lined, any offsets within the mainline or service lateral, any intrusion from the lateral into the main; the angle at which the connection comes in; any changes in angle of approach of the lateral for the length of the repair; the potential flows coming through the lateral pipe; the potential flows going through the sewer main pipe; the diametric size of the connection for the length of the liner; the size of the main pipe at the point of the liner and the presence of active infiltration within the vicinity of the work area. Cost to complete the necessary pipe cleaning and CCTV inspection will be included in the cost to install the lateral liner.

Two copies of the pre-lining inspection shall be submitted to the Public Utilities Dept. The Contractor shall be responsible for having a copy of the pre-lining inspections in the field as well. Immediately prior to liner insertion, the camera shall traverse the lateral to inspect for debris which may have entered the line after the existing condition video recording.

404-5.3.2. LATERAL PREPARATION

It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, roots, or broken pipe that will prevent the insertion of the liner. A high speed rotating hydraulic cutter shall be used to cut roots, grease or other obstructions in the pipe. The cut shall be made flush with the wall of the pipe to be restored, and the debris shall be pushed down the lateral pipe to the main pipe and to the downstream manhole and is to be removed by the contractor. If inspection reveals an obstruction that cannot be removed by conventional cleaning equipment, the Contractor shall notify the city and the cleaning effort shall be abandoned. The Contractor shall confirm that the sewer is clean enough to ensure an effective lining. The line segment shall not be lined until approved by the city.

Built-up deposits on the sewer main and lateral pipe walls shall be removed. The removal shall reach at least one foot beyond the liner product to allow the bladder to inflate tightly against the pipe walls ensuring a smooth transition from the liner product to the existing pipe wall.

Where the sewer main pipe has been lined previously with a CIPP liner, a check should be made to ensure the prior lateral reopening work created a lateral opening that is flush with the lateral pipe. If this is not the case, the mainline CIPP must be trimmed back using a lateral cutter.

Where active infiltration is present and when it is recommended by the liner manufacturer the infiltration must be stopped in advance by grouting.

404-5.3.3. LINER INSTALLATION

Notify all property owners not identified for service flow maintenance that their sewage service will be discontinued while the liner is being installed. Notify each affected property owner at least 7 days in advance of commencement of the work, giving the date, start time and time when service will be completely restored. Also provide a telephone number which property owners can call for information during the work.

If required for flow maintenance for selected services, Contractor shall excavate at the property line down to the service lateral for the installation of a cleanout. The preferred method of excavation shall be vacuum excavation. Although other installation techniques may be accepted, they must be pre-approved by the city. The service lateral shall be thoroughly cleaned prior to attaching the PVC wye connection. The riser pipe shall be sealed with a screw type plug, the excavation backfilled with sand or pea gravel, and the surface restored to preconstruction conditions.

Service lateral liner material shall be vacuum impregnated on site with the epoxy resin immediately prior to installation. Impregnation should be carried out under vacuum using electric impregnation table with pinch rollers set at the correct gap as per the manufacturer's instructions. Impregnation should take place in a clean, temperature-controlled cab in which the materials are protected from direct sunlight, objects which may damage the coating.

Impregnation should not take place using a manual roller in which the material is subject to excessive pressure and that the materials are squeezed resulting in a resin slug. All the calculated resin shall be confined to the liner to ensure the correct mechanical properties can be achieved.

Impregnation should not take place outside in an uncontrolled environment in which the materials are exposed to the elements. The liner should not be placed on the ground where it is susceptible to damage from objects such as stones, grit, glass etc. During and upon completion of the impregnation process the liner should be stored in a container to avoid damage prior to loading the material into the installation device.

The liner product shall be loaded inside a pressure apparatus above ground. The pressure apparatus, with an end attached to a robotic manipulator device, shall be positioned in the mainline pipe at the service connection that is to be rehabilitated. The robotic device together with a television camera will be used to align the repair product with the service connection opening. The robotic device shall hold the collar in place while air pressure, supplied to the pressure apparatus through a hose, shall be used to invert the liner into the lateral pipe. The insertion pressure will be adjusted to fully deploy the liner product into the lateral connection and hold the liner product tight to the main and lateral pipe walls.

After insertion is completed, recommended pressure must be maintained on the impregnated liner product for the duration of the curing process. The Contractor shall apply a heat source and circulation system to affect a cure of the epoxy system. The equipment shall be capable of uniformly raising the temperature of the pressurized fluid above the temperature required to affect a complete curing of the epoxy system. Initial cure shall be deemed to be completed when the temperature gauge on the heat source indicates that the temperature inside the tube is of a magnitude to realize an exotherm. The minimum cure period shall be as recommended by the system manufacturer.

The finished liner product shall be free of dry spots, lifts, delamination, and excess epoxy. The installed liner product should not inhibit the post installation video inspection, using a closed-circuit television camera, of the mainline and service lateral pipes or future pipe cleaning operations. During the warranty period any defects with the liner product that affect the performance or cleaning of the lateral connection shall be repaired at the contractor's expense in a manner acceptable to the city.

The Contractor shall inform the city of service laterals in which a liner product cannot be installed due to pre-existing conditions. These services will be identified, documented, video recorded, and the city will be

informed of the conditions encountered. The Contractor will not attempt to install a liner product in these services unless directed by the city.

Contractor may be permitted, at the direction of the city, to install service liners from inside the existing cleanout location to the main line sewer if conditions allow. Final liner product must include a lateral connection repair brim type liner to seal the connection at the host pipe and overlap the service liner installed from the cleanout.

404-5.3.4. TESTING AND ACCEPTANCE

Following installation of the service lateral liners, conduct a final, video recorded, CCTV/color television inspection of the completed work including the service lateral connections at the sewer main and the full length of all service laterals lined during the progress of the work. Copies of these recordings and those made prior to the liner installation shall be submitted to the city for approval and shall be retained by the city. Field acceptance of the liner shall be based on the city's evaluation of the installation including CCTV inspection video recordings and a review of certified test data for the installed pipe samples. groundwater infiltration of the liner shall be zero. There shall be no evidence of splits, cracks, breaks, lifts, kinks, delamination or crazing in the liner. If any defective liner is discovered after it has been installed, it shall be removed and replaced with either a sound liner or a new pipe at no additional cost to the city. The cost for all necessary testing shall be included in the cost associated with the lining.

The Contractor shall clean up each project area after the work is completed and all testing is accepted. Remove and dispose of all excess materials and debris at each location as directed by the city.

405. SANITARY MANHOLE LINER RESTORATION

405-1. SCOPE AND INTENT

It is the intent of this portion of the specification to provide for the repair, rehabilitation and groundwater infiltration abatement of manhole walls, corbels/cones, pipe connections and bench and channel/trough areas. All manhole rehabilitation products will be installed in accordance with the manufacturer's recommendations and these specifications. The purpose of the rehabilitation work is to eliminate inflow and infiltration, provide corrosion protection, and to restore the structural integrity of the manhole. For any particular system the Contractor will submit manufacturer's technical data and application instructions. All OSHA regulations shall be met in the completion of the work and the contractor shall be responsible for all necessary maintenance of traffic. The contractor shall warrant all work against defects in materials and workmanship for a period of one 1 years, unless otherwise noted, from the date of final acceptance of the project. Contractor shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said one year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the city.

The following lists all elements of potential rehabilitation activity:

1. REMOVE STEPS
2. STOP ACTIVE INFILTRATION.
3. PATCH VOIDS AND ALL FRAME CONNECTIONS WITH NON-SHRINK GROUT.
4. REMOVE LOOSE COATING MATERIALS.
5. RESURFACE CORBEL/WALLS WITH CEMENTITIOUS MORTAR.
6. REBUILD/REPAIR BENCH & CHANNEL/TROUGH/SEAL PIPE CONNECTIONS.
7. COAT CORBEL/CONE, WALLS, BENCH AND TROUGH WITH AN APPROVED CEMENTITIOUS, EPOXY, OR POLYURATHANE, COATING/LINING SYSTEM.
8. ADJUST FRAME AND COVER HEIGHT.
9. RESET FRAME AND COVER.

10. REMOVE ROOTS.
11. PROVIDE INFLOW INSERT/DISH/PAN.
12. REMOVE DEBRIS.
13. PERFORM STRUCTURAL REPAIR.
14. REPLACE FRAME AND COVER.
15. SEAL FRAME TO CORBEL/CONE CONNECTION WITH AN APPROVED POLYUREA COATING/LINING SYSTEM

It is implicit that many of the repair activities listed above will not be measured and paid for separately as they will be included in the cost of rehabilitating the manhole substrate. These activities include stopping active infiltration, patching voids, removal of loose coating materials, resurfacing of the corbel & wall, removing roots, and removing miscellaneous debris. Repair activities which will have a separate measurement and payment item include: Rebuilding/Repairing Bench & Channel/Trough; Interior Manhole Coating; Adjusting/Resetting Frame & Cover, Replacing Frame & Cover and Sealing Frame to Corbel Connection.

405-2. MEASUREMENT & PAYMENT

405-2.1. MANHOLE LINERS/COATING

Payment for manhole rehabilitation shall be per vertical linear foot of liner/coating which is installed/applied. Lining systems will generally be measured from the manhole bench to the top of existing, or new, corbel/cone. Cementitious, Epoxy and Polyurethane coating systems will be measured from the lowest pipe invert to the bottom of the manhole frame. No separate payment will be made for the following items: Flow Maintenance; Maintenance of Traffic; Debris Disposal; Miscellaneous Excavation, including necessary pavement removal and replacement; Infiltration control in manhole and at all pipe connections; Grout, Brick and mortar placement to fill voids and level surfaces; Brick replacement; Root removal, Installation of pipe extensions and connectors as necessary; Removal and replacement of manhole steps, Replacement of unpaved roadway and grass or shrubbery; Replacement of roadway base (including backfill and compaction) and asphalt surface; and Appurtenant work as required to complete the identified rehabilitation. The cost of such work shall be included in the pay item, per vertical linear foot of liner/coating.

405-2.2. REPLACE FRAME & COVER

Payment for manhole frame and cover replacement will include removal of existing frame and cover and replacement with a new frame and cover which meets the criteria established by *Section 401-4* of the city's specifications. The Contractor will also install and/or replace manhole pans and dishes if it is damaged or missing. Refer to *Section 401-2.2.* from these *Section IV Technical Specifications*. Where manholes fall in paved areas, refer to *Standard Detail Index 104, "Street and Driveway Replacement for Concrete and Asphaltic Concrete Surfaces"*. Payment will be made for each manhole frame and cover replaced. No separate payment will be made for maintenance of traffic, necessary pavement removal and replacement, or replacement of grass or shrubbery.

405-2.3. REBUILD BENCH & CHANNEL/TROUGH

Payment for rebuilding bench and channel/trough will include removal of existing bench and channel (if applicable) and constructing a new bench and channel using the criteria established by *Section 401-1* of the city's specifications. Payment will be made for each bench and channel repaired/installed. No separate payment will be made for the removal of the existing bench and channel, by-pass pumping, and preparation of the manhole invert.

405-2.4. RESET/ADJUST MANHOLE FRAME & COVER

Payment for adjusting, or resetting, manhole frame will include removal of existing frame, removal of existing mortar, preparing top of corbel surface, installation of necessary riser material as described in *Section 401-2.1*, and placement of existing frame. No separate payment will be made for necessary maintenance of traffic, pavement removal and replacement, or replacement of grass or shrubbery. All work will be performed in accordance with *Section 401-4* of the city's specifications. Where manholes fall in paved areas, refer to *Standard Detail Index 104*, "Street and Driveway Replacement for Concrete and Asphaltic Concrete Surfaces". Payment will be made for each manhole frame and cover adjusted. No separate payment will be made for maintenance of traffic, necessary pavement removal and replacement, or replacement of grass or shrubbery.

405-2.5. SEAL MANHOLE FRAME TO CORBEL CONNECTION WITH POLYUREA MATERIAL

Payment for providing a water tight connection between the manhole frame and the manhole corbel /cone will include placement of non-shrink grout in any area between the frame and corbel which is void of mortar, preparing the frame and corbel/cone to accept the polyurea material and testing the thickness of the application. No separate payment will be made for necessary maintenance of traffic. All work will be performed in accordance with *Section 405-7* of the city's specifications.

405-3. CEMENTITIOUS COATING SYSTEM

This specification shall govern all work to spray/apply a monolithic fiber reinforced cementitious liner to the wall, channel, invert and bench surfaces of brick, concrete, or any other construction material; Strong Seal MS 2C product or approved equal.

Described are procedures for manhole cleaning preparation, application of material and testing. The applicator must be approved, trained and certified as having successfully completed factory training. The applicator/contractor shall furnish all labor, equipment and materials for applying the Strong Seal MS 2C product directly to the contour of the manhole to form a structural cementitious liner of a minimum one half inch (1/2") thickness using a machine specially designed for the application. As it is the intention of the city to rehabilitate the entire structure; corbel, walls, bench and channel/trough the contractor will be required to provide by-pass pumping as the necessary cure time exceeds four (4) hours. In no case will flow through plugs be allowed. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications:

1. The elimination of active infiltration prior to making the application.
2. The removal of any loose and unsound material.
3. The spray application of a pre-blended cementitious mix to form a monolithic liner in a two (2) coat application.

405-3.1. SUBMITTALS

Submittals shall be made in accordance with the following:

1. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
2. Safety Data Sheets (SDS) for each product used.
3. Project specific guidelines and recommendations.
4. Applicator Qualifications:
    a. Manufacturer certification that the Applicator has been trained in the handling, mixing and application of the products to be used.

b. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
c. Written document providing three (3) years of experience and five (5) recent references of Applicator indicating successful application of the materials provided
d. Installed a minimum of 50,000 square feet of plural component spray applied coating the same or similar to that specified within the last two (2) years.
e. Proof of any necessary federal, state, or local permits or licenses necessary for the project.

405-3.2. MATERIALS

405-3.2.1. PATCHING MIX

A Strong A Seal or approved equal shall be used as a patching mix according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive Strength (ASTM C109)	15 min., 200 psi; 6 hrs., 1,400 psi
2.	Shrinkage (ASTM C596)	28 days, 150 psi
3.	Bond (ASTM C1072)	28 days, 150 psi
4.	Cement Sulfate resistant	
5.	Density, when applied	105 +/- 5 pcf

405-3.2.2. INFILTRATION CONTROL

A Strong A Plug or approved equal shall be used to stop minor water infiltration according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive strength (ASTM C109)	600 psi, 1 hr.; 1000 psi 24 hrs.
2.	Bond (ASTM C1072)	30 psi, 1 hr.; 80 psi, 24 hrs.

405-3.2.3. GROUTING MIX

Strong-Seal Grout or approved equal shall be used for stopping very active infiltration and filling voids according to the manufacturer's recommendations. The grout shall be volume stable and have a minimum twenty-eight (28) day compressive strength of 250 psi and a one (1) day strength of 50 psi.

405-3.2.4. COATING MIX

Strong Seal MS 2C or approved equal shall be used to form the monolithic liner covering all interior manhole surfaces and shall have the following minimum requirements at twenty-eight (28) days: The physical requirements must be verified by an independent, certified, third party testing laboratory within the last five years. The proposed third-party laboratory must be submitted with the bid package; any bid package not including the verifiable, independent third-party testing shall be ruled non-responsive and will be rejected.

1.	Compressive strength (ASTM C109)	3,000 psi
2.	Tensile strength (ASTM C496)	300 psi
3.	Flexural strength (ASTM C78)	600 psi
4.	Shrinkage (ASTM C596)	0% at 90% R.H.
5.	Bond (ASTM C1072)	130 psi
6.	Density, when applied	105 + pcf
7.	Chemical Resistance (ASTM D543/G20) immersion service for: a. Municipal sanitary sewer environment b. Sulfuric Acid, 30% c. Sodium Hydroxide, 10% d. Sodium Hypochlorite, 3%	

Fiberglass rods which are contained in the product shall be alkaline resistant and shall be one-half inch (1/2") to five-eighths inch (5/8") long with a diameter of 635 to 640 microns. Products shall, in the unmixed state, have a lead content not greater than two percent (2%) by weight. Strong Seal MS 2C shall be made with Calcium Aluminate Cement and shall be used according to the manufacturer's recommendations in applications where there is evidence of severe sulfide conditions.

Product must be factory blended requiring only the addition of water at job site. Bag weight shall be 50 to 51 pounds and contents must have a dry bulk density of 50 to 56 pounds per cubic foot. Cement content must be 65% to 75% of total weight of bag. One bag of product when mixed with correct amount of water must have a wet density of 95 to 108 pounds per cubic foot and must yield a minimum of 0.67 cubic foot of volume. Product shall not include any basic ingredient that exceeds maximum allowable EPA limit for any heavy metal.

Manufacturer must provide SDS sheets for product(s) to be used in reconstruction process. A two (2) coat application of liner material will be required (no exceptions) with the first coat rough troweled to force materials into cracks and crevices to set the bond. The second coat to be spray applied to assure a minimum of one-half inch (1/2") thickness after troweling or brush finishing to a relatively smooth finish.

405-3.2.5. WATER

Water shall be clean and potable not to exceed 80°F (Fahrenheit).

405-3.2.6. OTHER MATERIALS

No other material shall be used with the mixes previously described without prior approval or recommendation from the manufacturer.

405-3.3. APPLICATION EQUIPMENT

A specially designed machine consisting of an optimized progressive cavity pump capable of producing a minimum of 250 psi pumping pressure, contra blend mixer with twin ribbon paddles with discharge, and an air system for spray application of product. Equipment must be complete with water storage and metering system. Mixer and pump are to be hydraulically powered. Equipment is to be mounted to heavy duty construction tandem axle road worthy trailer complete with electric brakes and running lights. Internal combustion engine must be included to power the hydraulic system and air compressor.

405-3.4. INSTALLATION AND EXECUTION

405-3.4.1. PREPARATION

1. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 1,200 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with brick and quick setting patching mix.
2. Active leaks shall be stopped using quick setting specially formulated mixes according to the manufacturer's recommendations. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.
3. Any bench, invert/channel/trough or service line repairs shall be made at this time using the quick setting mix and following the manufacturer's recommendations.
4. Any active flows shall be dammed, plugged, or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated until final applications are cured as recommended by the manufacturer.

5. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify city, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

405-3.4.2. MIXING

For each bag of product, use the amount of water specified by the manufacturer and mix using the Spray Mate Model 35C or 35D equipment for thirty (30) seconds to one (1) minute after all materials have been placed in the mixing hopper. Place the mix into the holding hopper and prepare another batch with timing such that the nozzleman can spray in a continuous manner without interruption until each application is complete.

405-3.4.3. SPRAYING

The surface, prior to spraying, shall be damp without noticeable free water droplets or running water. Materials shall be sprayed, applied to a minimum uniform thickness to ensure that all cracks, crevices and voids are filled, and a somewhat smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond. Not before the first application has begun to take an initial set (disappearance of surface sheen which could be fifteen (15) minutes to one (1) hour depending upon ambient conditions) is the second application made to assure a minimum total finished thickness of one-half inch (1/2”). The surface is then troweled to a smooth finish being careful not to over trowel so as to bring additional water to the surface and weaken it. A brush finish may be applied to the finished coat to remove trowel marks. Manufacturer's recommendation shall be followed whenever more than twenty-four (24) hours have elapsed between applications. The bench will be sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than one-half inch (1/2”). The invert/channel/trough area shall also be sprayed in a manner that provides a gradual slope through the structure while achieving one-quarter inch (1/4”) thickness coverage. The wall/bench and bench/invert/channel/trough intersections shall be rounded to a uniform radius, the full circumference of the intersection. The final application shall have a minimum of four (4) hours cure time before being subjected to active flow. The corbel/cone to manhole frame joint shall be sealed according to *Section 405-7*.

405-3.4.4. PREPARATION OF SAMPLES

At some point during the application, at least four (4) two inch (2”) cubes will be prepared for each manhole, or from every fifty (50) bags of product used, identified and submitted, in accordance with the city's or Manufacturer's directions, for compression strength testing as described in ASTM C109.

405-3.4.5. CURING

Ambient manhole conditions are adequate for curing so long as the manhole is covered. It is imperative that the manhole be covered as soon as possible after the application has been completed.

405-3.5. TESTING AND ACCEPTANCE

Manhole will be vacuum tested from the top of manhole frame to the manhole base. All pipes entering the manhole shall be plugged, taking care to securely place the plug from being drawn into the manhole. The test head shall be placed, and the seal inflated in accordance with the manufacturers' recommendations. A vacuum pump of ten inches (10”) of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to nine inches (9”). The manhole shall pass if the time is greater than sixty (60) seconds for forty-eight inch (48”) diameter, seventy five (75) seconds for sixty inch diameter (60”), and ninety (90) seconds for seventy-two inch (72”) diameter manholes. If the manhole fails the initial test, necessary repairs shall be made. Retesting shall proceed until a satisfactory test is obtained. Tests shall be performed by the Contractor under the direction of the city.

405-4. RAVEN 405 EPOXY COATING SYSTEM

This specification shall govern all work to spray/apply a monolithic epoxy material to the wall, channel, invert and bench surfaces of brick, concrete, or any other construction material; Raven 405 product or approved equal.

Described are procedures for manhole cleaning preparation, application of material and testing. The applicator must be approved, trained, and certified as having successfully completed factory training. The applicator/contractor shall furnish all labor, equipment, and materials for applying the Raven 405 product directly to the contour of the manhole to form a structural liner of a minimum 125 mil thickness using a machine specially designed for the application. As it is the intention of the city to rehabilitate the entire structure; corbel, walls, bench, and channel/trough the contractor will be required to provide by-pass pumping as necessary if the cure time exceeds one (1) hour. In no case will flow through plugs be allowed. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications:

1. The elimination of active infiltration prior to making the application.
2. The removal of any loose and unsound material.
3. Preparing the manhole to provide a clean, dry, sound and monolithically smooth surface
4. The spray application of a Solvent-free epoxy coating to be applied to specified thickness

405-4.1. SUBMITTALS

Submittals shall be made in accordance with the following:

1. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
2. Safety Data Sheets (SDS) for each product used.
3. Project specific guidelines and recommendations.
4. Applicator Qualifications:
    a. Manufacturer certification that the Applicator has been trained in the handling, mixing and application of the products to be used.
    b. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
    c. Written document providing three (3) years of experience and five (5) recent references of Applicator indicating successful application of a 100% solids high-build solvent-free coating by spray application.
    d. Applicator must provide written documentation of having installed a minimum of 50,000 square feet of plural component spray applied epoxy coating the same or similar to that specified within the last two (2) years.
    e. Proof of any necessary federal, state, or local permits or licenses necessary for the project.

405-4.2. MATERIALS

405-4.2.1. PATCHING MIX

Strong Seal, or approved equal, shall be used as a patching mix according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive Strength (ASTM C-109)	15 min., 200 psi; 6 hrs., 1,400 psi
2.	Shrinkage (ASTM C-596)	28 days, 150 psi
3.	Bond (ASTM C-952)	28 days, 150 psi
4.	Cement Sulfate resistance	

5.	Density, when applied	105 +/- 5 pcf

405-4.2.2. INFILTRATION CONTROL

Strong Plug, or approved equal, shall be used to stop minor water infiltration according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive strength (ASTM C109)	600 psi, 1 hr.; 1000 psi 24 hrs.
2.	Bond (ASTM C1072)	30 psi, 1 hr.; 80 psi, 24 hrs.

405-4.2.3. GROUTING MIX

Strong-Seal Grout, or approved equal, shall be used for stopping very active infiltration and filling voids according to the manufacturer's recommendations. The grout shall be volume stable and have a minimum twenty-eight (28) day compressive strength of 250 psi and one (1) day strength of 50 psi.

405-4.2.4. COATING MATERIAL

Coating product shall be applied to all interior surfaces to protect the host substrate and repair materials from all forms of chemical or bacteriological attack typically found in municipal sanitary sewer systems and to impart a degree of structural enhancement.

Coating product physical properties shall be substantiated through submittal of accredited third-party testing results and shall be representative of the actual field applied product and cure mechanism(s) to be employed in the field. The physical requirements must be verified by an independent third-party testing shall be ruled non-responsive and will be rejected.

100% Solids, Solvent-Free, Ultra-High Build Epoxy Coating to be spray applied to all interior surfaces of exposed concrete above the spring line or as otherwise detailed:

1. Manufacturer: Raven Lining Systems, Broken Arrow, Oklahoma 800-324-2810 or 918-615-0140 fax.
2. Product: Raven 405, or approved equal – 100% solids, solvent-free ultra-high-build epoxy system exhibiting the following characteristics:
    a. Product Type: amine cured epoxy
    b. VOC Content (ASTM D2584): 0%
    c. Compressive Strength, (ASTM D695): 18,000 psi
    d. Tensile Strength, (ASTM D638): 7,600 psi
    e. Flexural Modulus, (ASTM D790): 700,000 psi
    f. Adhesion to Concrete, (ASTM D4541/7234): >200 psi with substrate (concrete) failure
    g. Chemical Resistance (ASTM D543/G20) immersion service for:
        - Municipal sanitary sewer environment
        - Sulfuric Acid, 30%
        - Sodium Hydroxide, 10%
        - Sodium Hypochlorite, 3%
    h. Successful Pass: Sanitation District of L.A. County Coating Evaluation Study and SSPWC 210.2.3.3 (Greenbook “Pickle Jar” Chemical Resistance test) 100% Solids, Solvent-Free, Ultra-High Build Epoxy Coating to be manually or spray applied to interior surfaces of exposed concrete above or below the typical flow line; specifically designed for accelerated cure and suitable for release of flow in less than 45 minutes at normal service temperatures or as otherwise detailed.

405-4.2.5. OTHER MATERIALS

No other material shall be used with the mixes previously described without prior city approval.

405-4.3. INSTALLATION AND EXECUTION

405-4.3.1. PREPARATION

1. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 5,000 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with brick and quick setting patching mix.
2. Active leaks shall be stopped using quick setting specially formulated mixes according to the manufacturer's recommendations. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.
3. Any bench, invert/channel/trough or service line repairs shall be made at this time using the quick setting mix and following the manufacturer's recommendations.
4. Any active flows shall be dammed, plugged, or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated until final applications are cured as recommended by the manufacturer.
5. The area between the corbel and the manhole frame and any other area that might exhibit movement or cracking due to expansion and contraction shall be grouted with a flexible grout or gel. A termination groove “key” cut into the substrate between the bottom of the manhole frame and concrete is recommended for placement of the flexible grout or gel. The “key” shall be a minimum ¼” w x ¼” d, cut at a minimum 45º angle (60º maximum).
6. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify city, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

405-4.3.2. APPLICATION

Application procedures shall conform to the recommendations of the coating product(s) manufacturer, including environmental controls, product handling, mixing, application equipment, and methods. Spray equipment shall be specifically designed to accurately ratio and apply the coating product(s) and s Prepared surfaces shall be coated via spray application of the coating product(s) described herein unless otherwise recommended by the coating product manufacturer.

In all cases the coating product shall be applied to a minimum dry film thickness of 125 mils to surface profiles. Subsequent top coating or additional coats of the coating product(s) shall occur within the products recoat window. Additional surface preparation procedures will be required if this recoat window is exceeded.

Coating product(s) shall interface with adjoining construction materials/components throughout the manhole structure to effectively seal and protect substrates from attack by corrosive elements and to ensure the effective elimination of infiltration into the sewer system. Termination points of the coating product(s) shall be made at the manhole frame and corbel joint (or other man way as is present), and a minimum of 1” interfacing within each pipe penetrating the structure. The corbel/cone to manhole frame joint shall be sealed according to *Section 405-7*. The entire bench and invert/channel/trough will be thoroughly coated noting that the invert/channel/trough area will be sprayed in a manner that provides a gradual slope through the structure while achieving 125 mils thickness coverage.

405-4.4. TESTING & ACCEPTANCE

Coating system thickness shall be inspected to ensure compliance with the specifications herein.

1. During application a wet film thickness gauge, meeting ASTM D4414 (latest edition) - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be

used. Measurements shall be taken, documented, and attested to by Contractor for submission to the city.
2. After the coating product(s) have cured in accordance with manufacturer recommendations, coating system thickness shall be measured according to SSPC-PA 9 - Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages.

High voltage holiday detection for coating systems installed in corrosive environments, when it can be safely and effectively employed, shall be performed to ensure monolithic protection of the substrate. After the coating product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays in accordance with NACE RPO 188-99 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates or ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates. All detected holidays shall be marked and repaired according to the coating product(s) manufacturer's recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of coating system thickness.
2. Detection of a known or induced holiday in the coating product shall be confirmed to ensure proper operation of the test unit.
3. All areas repaired shall be retested following cure of the repair material(s).
4. In instances where high voltage holiday detection is not feasible a close visual inspection shall be conducted, and all possible holidays shall be marked and repaired as described above.
5. Documentation of areas tested, equipment employed, results, and repairs made shall be submitted to the city by the Contractor.

Adhesion of the coating system to the substrate shall be confirmed in a minimum of 10% of the manholes coated, or for large structures once every 1000 square feet of coated area. After the coating product(s) have cured in accordance with manufacturer recommendations, testing shall be conducted in accordance with ASTM D7234 Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers. city's Project Manager shall select the manholes/areas to be tested.

1. For each test manhole a minimum of three 20 mm dollies shall be affixed to the coated surface; one at the cone/corbel area, one at the midsection and one near the bottom of the structure.
2. For larger structures a minimum of three 20 mm dollies shall be affixed to the coated surface at random locations within each 1000 square foot area or as otherwise agreed upon.
3. The adhesive used to attach the dollies to the coating shall be rapid setting with tensile strengths in excess of at least twice the anticipated failure point (generally 1000 psi) and permitted to cure in accordance with manufacturer recommendations. The coating and dollies shall be adequately cleaned and prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting.
4. Prior to performing the pull test, the coating shall be scored to the substrate, or within 10 mils of the substrate surface, by mechanical means without disturbing the dolly or coating system bond within the test area.
5. Two of the three adhesion pulls in each test area shall exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of the coating product in the test hole. Pulls tests with results between 150 and 200 psi may be acceptable if more than 50 percent of the substrate in the test area is adhered to the dolly.
6. Should a structure, or area, fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner or Project Engineer. Any areas detected to have inadequate bond strength shall be evaluated by the city. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.
7. All adhesion testing shall be performed by qualified personnel using calibrated equipment as specified by the applicable ASTM standard(s).

8. All adhesion testing shall be documented and submitted in a consistent format detailing location, test values, description of the failure point/mode, scoring method employed, adhesive used, cure time of coating and adhesive and other data as deemed necessary by the city.
9. All adhesion test locations shall be repaired by the Contractor at no cost to the city.
10. Visual inspection shall be made by the Project Engineer and/or Inspector. Any deficiencies in the finished coating affecting the performance of the coating system or the operational functionality of the structure shall be marked and repaired according to the recommendations of the coating product(s) manufacturer.

405-5. SPRAYWALL POLYURETHANE COATING SYSTEM

This specification shall govern all work to spray/apply a monolithic polyurethane material to the wall, channel, invert and bench surfaces of brick, concrete, or any other construction material; SprayWall product or approved equal.

Described are procedures for manhole cleaning preparation, application of material and testing. The applicator must be approved, trained and certified as having successfully completed factory training. The applicator/contractor shall furnish all labor, equipment and materials for applying the SprayWall product directly to the contour of the manhole to form a structural liner of a minimum 125 thickness using a machine specially designed for the application. As it is the intention of the city to rehabilitate the entire structure; corbel, walls, bench and channel/trough the contractor will be required to provide by-pass pumping as the necessary if the cure time exceeds one (1) hour. In no case will flow through plugs be allowed. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications:

1. The elimination of active infiltration prior to making the application.
2. The removal of any loose and unsound material.
3. Preparing the manhole to provide a clean, dry, sound and monolithically smooth surface
4. The spray application of a Solvent-free polyurethane coating to be applied to specified thickness.

405-5.1. SUBMITTALS

The following items shall be submitted:

1. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
2. Safety Data Sheets (SDS) for each product used.
3. Project specific guidelines and recommendations.
4. Applicator Qualifications:
    a. Manufacturer certification that the Applicator has been trained in the handling, mixing and application of the products to be used.
    b. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
    c. Written document providing three (3) years of experience and five (5) recent references of Applicator indicating successful application of a 100% solids high-build solvent-free coating by spray application.
    d. Written document stating that the contractor has installed a minimum of 50,000 square feet of plural component spray applied polyurethane coating the same or similar to that specified within the last two (2) years.
    e. Proof of any necessary federal, state or local permits or licenses necessary for the project.

405-5.2. MATERIALS

405-5.2.1. PATCHING MIX

Strong Seal, or approved equal, shall be used as a patching mix according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive Strength (ASTM C109)	15 min., 200 psi; 6 hrs., 1,400 psi
2.	Shrinkage (ASTM C596)	28 days, 150 psi
3.	Bond (ASTM C952)	28 days, 150 psi
4.	Cement Sulfate resistant	
5.	Density, when applied	105 +/- 5 pcf

405-5.2.2. INFILTRATION CONTROL

Strong Plug, or approved equal, shall be used to stop minor water infiltration according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive strength (ASTM C109)	600 psi, 1 hr.; 1000 psi 24 hrs.
2.	Bond (ASTM C952)	30 psi, 1 hr.; 80 psi, 24 hrs.

405-5.2.3. GROUTING MIX

Strong-Seal Grout, or approved equal, shall be used for stopping very active infiltration and filling voids according to the manufacturer's recommendations. The grout shall be volume stable and have a minimum twenty-eight (28) day compressive strength of 250 psi and a one (1) day strength of 50 psi.

405-5.2.4. COATING MATERIAL

The resin-based material shall be used to form the sprayed structurally enhanced monolithic liner covering all interior surfaces of the structure, including benches and channels/troughs of manholes. The finished liner shall be SprayWall® as manufactured by Sprayroq, Inc. or approved equal and conform to the minimum physical requirements listed below. A minimum of 125 mil. coating thickness is required.

The physical requirements must be verified by an independent, certified, third party testing laboratory within the last five years and must be submitted with the bid package. Any bid package not including the verifiable, independent third-party testing shall be ruled non-responsive and will be rejected.

1.	VOC Content (ASTM D2584)	0%
2.	Compressive Strength, (ASTM D695)	18,000 psi
3.	Tensile Strength, (ASTM D638)	> 7,450 psi
4.	Flexural Modulus, (ASTM D790)	735,000 psi
5.	Adhesion to Concrete, (ASTM D4541/7234)	>200 psi with substrate (concrete) failure
6.	Chemical Resistance (ASTM D543/G20) immersion service for:	• Municipal sanitary sewer environment • Sulfuric Acid, 30% • Sodium Hydroxide, 10% • Sodium Hypochlorite, 3%
7.	Successful Pass:	Sanitation District of L.A. County Coating Evaluation Study and SSPWC 210.2.3.3 (Greenbook “Pickle Jar” Chemical Resistance test)

The initial flexural modulus of elasticity (short term) of the submitted resin material will be utilized with the long-term deformation percentage as determined by ASTM D2990 (see below) in the design equation outlined in ASTM 1216-09, Appendix X1. The value of the long-term flexural modulus of the proposed product will be certified by an independent, certified, third party testing lab, independent of the

Manufacturer and submitted with the bid package. [The definition of long-term value will be identified as initial flexural VER 01 w/Flat Wall 2015 Page 7 of 12 modulus of elasticity less the reduction in value caused by Creep over a fifty (50) year minimum period and verified by third party DMA testing (ASTM D2990).] All design submittals will include this certified third-party DMA testing (ASTM D2990) value in their respective design calculations for each structure being rehabilitated.

Coating product physical properties shall be substantiated through submittal of accredited third-party testing results and shall be representative of the actual field applied product and cure mechanism(s) to be employed in the field.

Polyurethane coating to be manually or spray applied to interior surfaces of exposed concrete above or below the typical flow line; specifically designed for accelerated cure and suitable for release of flow in less than 45 minutes at normal service temperatures or as otherwise detailed.

405-5.2.5. OTHER MATERIALS

No other material shall be used with the mixes previously described without prior approval or recommendation from the manufacturer.

405-5.3. INSTALLATION AND EXECUTION

405-5.3.1. PREPARATION

1. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 5,000 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with brick and quick setting patching mix.
2. Active leaks shall be stopped using quick setting specially formulated mixes according to the manufacturer's recommendations. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.
3. Any bench, invert/channel/trough or service line repairs shall be made at this time using the quick setting mix and following the manufacturer's recommendations.
4. Any active flows shall be dammed, plugged, or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated until final applications are cured as recommended by the manufacturer.
5. The area between the corbel and the manhole frame and any other area that might exhibit movement or cracking due to expansion and contraction, shall be grouted with a flexible grout or gel (Sikadur 42 Grout Pak LE, Pro-Stik Butyl Sealant, or equal). A termination groove “key” cut into the substrate between the bottom of the manhole frame and concrete is recommended for placement of the flexible grout or gel. The “key” shall be a minimum ¼” w x ¼” d, cut at a minimum 45º angle (60º maximum).
6. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify city, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

405-5.3.2. APPLICATION

Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order.

The protective coating material must be spray applied by a Certified Applicator of the protective coating manufacturer. Specified surfaces shall be coated by spray application of a solvent-free, 100% solids, rigid polyurethane structural lining as further described herein. Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. The air source is to be filtered to completely remove all oil and water.

If necessary, subsequent top coating or additional coats of the protective coating should occur as soon as the basecoat becomes tack free, no later than the recoat window for the specified products. Additional surface preparation procedures will be required if this recoat window is exceeded.

The roughness of the substrate will dictate the thickness needed to create the monolithic liner and eliminate any opportunity for voids in the coating. The minimum value for coating thickness shall be a minimum 125 mils.

Coating product(s) shall interface with adjoining construction materials/components throughout the manhole structure to effectively seal and protect substrates from attack by corrosive elements and to ensure the effective elimination of infiltration into the sewer system.

Termination points of the coating product(s) shall be made at the manhole frame and corbel joint (or other man way as is present), and a minimum of 1" interfacing within each pipe penetrating the structure. The entire bench and invert/channel/trough will be thoroughly coated noting that the invert/channel/trough area will be sprayed in a manner that provides a gradual slope through the structure while achieving 125 mils. thickness coverage.

405-5.4. TESTING & ACCEPTANCE

Coating system thickness shall be inspected to ensure compliance with the specifications herein.

1. During application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used. Measurements shall be taken, documented, and attested to by Contractor for submission to the city.
2. After the coating product(s) have cured in accordance with manufacturer recommendations, coating system thickness may be measured according to SSPC-PA 9 - Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages.

High voltage holiday detection for coating systems installed in corrosive environments, when it can be safely and effectively employed, shall be performed to ensure monolithic protection of the substrate. After the coating product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays in accordance with NACE RPO 188-99 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates or ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates. All detected holidays shall be marked and repaired according to the coating product(s) manufacturer's recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of coating system thickness.
2. Detection of a known or induced holiday in the coating product shall be confirmed to ensure proper operation of the test unit.
3. All areas repaired shall be retested following cure of the repair material(s).
4. In instances where high voltage holiday detection is not feasible a close visual inspection shall be conducted, and all possible holidays shall be marked and repaired as described above.
5. Documentation of areas tested, equipment employed, results, and repairs made shall be submitted to the city by the Contractor.

Adhesion of the coating system to the substrate shall be confirmed in a minimum of 10% of the manholes coated, or for large structures once every 1000 square feet of coated area. After the coating product(s) have cured in accordance with manufacturer recommendations, testing shall be conducted in accordance with

ASTM D7234 Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers. City's Project Manager shall select the manholes/areas to be tested.

1. For each test manhole a minimum of three 20 mm dollies shall be affixed to the coated surface; one at the cone/corbel area, one at the midsection and one near the bottom of the structure.
2. For larger structures a minimum of three 20 mm dollies shall be affixed to the coated surface at random locations within each 1000 square foot area or as otherwise agreed upon.
3. The adhesive used to attach the dollies to the coating shall be rapid setting with tensile strengths in excess of at least twice the anticipated failure point (generally 1000 psi) and permitted to cure in accordance with manufacturer recommendations. The coating and dollies shall be adequately cleaned and prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting.
4. Prior to performing the pull test, the coating shall be scored to the substrate, or within 10 mils of the substrate surface, by mechanical means without disturbing the dolly or coating system bond within the test area.
5. Two of the three adhesion pulls in each test area shall exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of the coating product in the test hole. Pulls tests with results between 150 and 200 psi may be acceptable if more than 50 percent of the substrate in the test area is adhered to the dolly.
6. Should a structure, or area, fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner or Project Engineer. Any areas detected to have inadequate bond strength shall be evaluated by the city. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.
7. All adhesion testing shall be performed by qualified personnel using calibrated equipment as specified by the applicable ASTM standard(s).
8. All adhesion testing shall be documented and submitted in a consistent format detailing location, test values, description of the failure point/mode, scoring method employed, adhesive used, cure time of coating and adhesive and other data as deemed necessary by the city.
9. All adhesion test locations shall be repaired by the Contractor at no cost to the city.
10. Visual inspection shall be made by the city's agent and/or Inspector. Any deficiencies in the finished coating affecting the performance of the coating system or the operational functionality of the structure shall be marked and repaired according to the recommendations of the coating product(s) manufacturer.

405-6. INTERNAL MANHOLE CORBEL SEALING SYSTEM

This specification shall govern all work to spray/apply a monolithic polyurea material to the frame and adjacent corbel surfaces of brick, concrete or any other construction material.

The work covered by this item includes but is not limited to furnishing all labor, equipment, materials and supervision, and performing all work necessary to seal the manhole as specified herein or equal to the manhole through the frame joint area and the area above the manhole corbel/cone.

Described are procedures for manhole/frame cleaning preparation, application of material and testing. The applicator must be approved, trained and certified as having successfully completed factory training. The applicator/contractor shall furnish all labor, equipment and materials for applying the product directly to the manhole and frame joint with a minimum of 6-inch overlap on each surface and a minimum thickness of 125 mils. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications:

1. The removal of any rust or loose and unsound material.

2. Preparing the manhole corbel/cone and frame to provide a clean, dry, sound and monolithically smooth surface
3. The spray application of a Solvent-free polyurea coating to be applied to specified thickness.

405-6.1. SUBMITTALS

The following items shall be submitted:

1. Technical data sheet, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
2. Safety Data Sheet for the product (SDS).
3. Project specific guidelines and recommendations.
4. Applicator Qualifications:
    a. Manufacturer certification that the Applicator has been trained in the handling, mixing and application of the products to be used.
    b. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
    c. Written document providing three (3) years of experience and five (5) recent references of Applicator indicating successful application of a 100% solids high-build solvent-free coating by spray application.
    d. Proof of any necessary federal, state, or local permits or licenses necessary for the project.

405-6.2. MATERIALS

405-6.2.1. PATCHING MIX

Strong Seal, or approved equal, shall be used as a patching mix according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive Strength (ASTM C109)	15 min., 200 psi; 6 hrs.; 1,400 psi
2.	Shrinkage (ASTM C596)	28 days, 150 psi
3.	Bond (ASTM C952)	28 days, 150 psi
4.	Cement Sulfate resistant	
5.	Density, when applied	105 +/- 5 pcf

405-6.2.2. INFILTRATION CONTROL

Strong Plug, or approved equal, shall be used to stop minor water infiltration according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive strength (ASTM C109)	600 psi, 1 hr.; 1000 psi 24 hrs.
2.	Bond (ASTM C952)	30 psi, 1 hr.; 80 psi, 24 hrs.

405-6.2.3. COATING MATERIAL

Manhole seal shall be designed to prevent leakage of water into the manhole through the frame joint area and the area above the manhole cone including all extensions to the corbel area. The seal shall remain flexible allowing for the repeated vertical or horizontal movements of the frame due to frost lift, ground movement or the thermal movement of pavements. The final coating shall be made no less than 125 mils. of corrosion resistant aromatic or approved equal. The product shall have a minimum elongation of 800%. Final liner shall have a minimum tensile strength of 3250 psi. The manhole sealing system shall conform to the physical requirements of ASTM D412.

The physical requirements must be verified by an independent, certified, third party testing laboratory within the last five years and must be submitted with the bid package. Any bid package not including the verifiable, independent third-party testing shall be ruled non-responsive and will be rejected.

405-6.3. INSTALLATION AND EXECUTION

405-6.3.1. PREPARATION

1. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 5,000 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with brick and quick setting patching mix.
2. All patching materials shall be cured prior to the installation. Preparation of the frame surface shall include sandblasting (minimum of 70 CFM) and an acetone wet wipe to ensure a clean surface as required by manufacturer on uncoated substrate.
3. If coating is to be on top of SprayWall, or Raven 405, then termination points need to be cut which are ¼" x ¼" cut on 45° angle at top and bottom of application, then sanding of the SprayWall, or Raven 405, with 40 grit paper, cleaned and an application of Lords 7701 is required prior to application to ensure adhesion.
4. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify city, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

405-6.3.2. APPLICATION

Application procedures shall conform to the recommendations of the polyurea coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment.

The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order. The polyuria coating material must be spray applied by a Certified Applicator of the coating manufacturer.

Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. The air source is to be filtered to completely remove all oil and water.

If necessary, subsequent top coating or additional coats of the polyurea coating should occur as soon as the basecoat becomes tack free, no later than the recoat window for the specified products. Additional surface preparation procedures will be required if this recoat window is exceeded.

405-6.3.3. TESTING & ACCEPTANCE

Coating system thickness shall be inspected to ensure compliance with the specifications herein.

1. During application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used. Measurements shall be taken, documented, and attested to by Contractor for submission to the city.
2. After the coating product(s) have cured in accordance with manufacturer recommendations, coating system thickness may be measured according to SSPC-PA 9 - Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages.
3. Visual inspection shall be made by the city's agent and/or Inspector. Any deficiencies in the finished coating affecting the performance of the coating system or the operational functionality of the structure shall be marked and repaired according to the recommendations of the coating product(s) manufacturer. The contractor shall warrantee proper adhesion of the coating material to the frame and corbel/cone for a minimum of ten (10) years.

406. SMOKE AND DYE TESTING

406-1. GENERAL PROTOCOL

Conduct smoke testing of gravity sewers for defects and identify manholes which could not be located, and all new structures not shown on GIS. Smoke and Dye testing will be completed using the following Protocols:

Smoke testing will provide detailed information on wet weather inflow sources to the sanitary sewer. In order to identify collection system defects and illicit connections, non-toxic smoke will be forced into the sewer by high-capacity blower capable of achieving a minimum of 1,750 cfm of airflow. Any break in the sewer will allow the smoke to escape provided the smoke machine generates sufficient pressure. One line segment will be tested at one time with plugging. The maximum length of sewer to be smoke tested in a single setup shall be 400 linear feet per blower. Dual blower smoke testing shall be performed for pipe sections over 400 linear feet with a maximum of 800 linear feet. Smoke testing shall not be performed during or following weather conditions that may impair detecting escaping smoke (i.e. very windy, rainy, or high groundwater conditions, etc.) Smoke testing will not be performed on surcharged lines. In case of surcharged lines, the selected Contractor will contact the city and identify the issue. Once the surcharge has been eliminated, the city will contact the selected Contractor to re-smoke the test area. Smoke testing will document when smoke does not travel the entire length of piping, or when smoke is not detected at the roof stack of connecting buildings. In these cases, CCTV inspection (by others) will be required of both mainline and lateral piping. When a defect is identified as being a potential significant inflow source it will be recommended for dye testing. The smoke shall be non-toxic, odorless, and non-staining. A Safety Data Sheet shall be submitted and approved by city prior to the commencement of smoke testing.

Prior to testing, the selected Contractor shall submit a schedule outlining test dates and locations to the city, three weeks prior to commencing the smoke testing. The selected Contractor shall prepare Smoke Testing notices (English & Spanish) advising residents and local authorities of the smoke testing program. The notices shall be approved by the city prior to distribution. Extra copies of the notices will be provided to the city for distribution to other city agencies, including the Fire Department, Police Department, Emergency Services and others. The selected Contractor shall distribute smoke testing notices to residences in the project area including the local fire and police precincts, approximately 48-72 hours in advance of the smoke testing. For large facilities such as schools or hospitals, a log will be maintained that documents the property manager's notification of planned smoke testing activities. A local Contractor's telephone number will be provided for those individuals with questions or for anyone requiring special assistance. Field personnel will be uniformed and will conspicuously display identification badges. Private individuals requesting additional identification will be asked to contact the city and crews shall carry a letter from the city authorizing the holder of the letter to perform the work described. Each day the fire department and other affected agencies will be notified of the crew location since smoke may enter homes through defective plumbing.

406-2. REPORTING

Field results shall be documented in an Excel spreadsheet and on printed maps. The Excel spreadsheet shall include the following information:

a. defect and photo number
b. address and locations of defects
c. type of defect found
d. is defect public or private
e. address of residences that did not smoke during testing and residents' houses that were smoked with defect description (if possible)

f. address of residences that did not have a cleanout plug(s) or lids and or in low-lying areas
g. manholes ID on those with no manhole inserts, with debris, or in low-lying areas
h. any defective sewer mains found in the field.

The printed and digital maps shall include the following:

a. boundary of the test area
b. sanitary sewer line segments tested
c. location and boundary of blower setups
d. locations of defects with defect number and photo of defect
e. address of residences that did not smoke during testing (plumbing roof vent: negative) and residences that smoke in house
f. ID numbers for manhole missing water-tight manhole inserts
g. location of smoking storm sewer catches basins

The field documentation will include:

a. sketched of the location and nature of each system defect
b. pertinent information for prioritizing repair of the defects
c. information needed to assess the best mitigation method
d. color digital photographs will be taken to document defects during smoke testing
e. location of defect will be measured from permanent objects (corner of house, light pole, etc.).

In addition to the standard documentation procedure, each smoke testing crew will be equipped with a computer tablet which is 'blue-toothed' to a GPS receiver. The crew can see their location on the downloaded 'cloud-based' map and as inflow sources are identified photographs will be taken to document each defect and an X, Y coordinate value will be assigned to each image. As each defect image is automatically uploaded to the 'cloud-based' map a defect type code will be attached to the image. Each inflow source or defect can then be displayed on the map and each defect type is assigned a different symbol/color/indicator. This form of documentation allows for comprehensive QA/QC of each completed smoke test and assurance that no defect is left unrecorded. The following is an overview of the required smoke testing process and reporting.

1. Field review the area selected area and note on the map all "hundred block" addresses.
2. Distribute smoke notice to all homes, businesses, schools, police and Fire & Rescue, etc. In addition, Fire & Rescue will be notified of any proposed smoke testing activities forty-eight to seventy-two hours prior to initiation.
3. During the initial field review, identify all types of businesses, specifically any doctors' offices, hospitals, schools, retirement homes (communities), assisted living facilities (ALFs), or any other establishment that may need special consideration and handling during the actual smoke test. Strict consideration and coordination with customers who have sensitive needs must be adhered to, some of whom will not be included on any smoke testing schedule as the nature of their business, such as hospitals, is far too delicate.
4. Twenty-Four hours minimum must expire from the issuance of smoke testing notices to allow all affected to prepare for the testing. For special exceptions, such ALFs and persons with health problems living at home, etc., direct in person of telephone contact shall be made if at all possible.
5. On the day of the testing, the selected portion of the study area will be identified and all street names and related hundred block addresses will be given to the police and fire department/emergency personnel for the area where the testing will occur. UNDER NO CIRCUMSTANCES WILL THE AREA SELECTED FOR THAT DAY'S TESTING BE MODIFIED TO INCLUDE ADDITIONAL WORK UNLESS THE POLICE & FIRE DEPARTMENT/EMERGENCY PERSONNEL HAVE BEEN NOTIFIED FIRST. The name and ID number of the fire department person contacted will be documented on the appropriate form.

The fire department/emergency personnel will be provided the exact locations and specific time frames of where and when the tests will be performed.

6. Multi-day scheduling with one-time reporting to the police and fire department/emergency personnel will not be permitted.
7. The city's Project Manager will be notified on a daily basis with the same information.
8. Should the fire department/emergency personnel respond to the target area during the actual smoke testing, all testing will cease immediately and the Smoke Testing Team's field supervisor in charge will contact the fire unit responding to answer any questions that the fire department officer may have.
9. All testing activity will cease when any resident complains of smoke entering their establishment. Smoke Testing Team's field personnel will then attempt to isolate where the smoke is entering the establishment and make the occupant aware of what the problem may be. All defective plumbing found inside should be documented appropriately for future reference. The occupant will be advised to have the defect repaired by a licensed plumber.
10. During the actual smoke testing, Smoke Testing Team field personnel will scout the area for smoke escaping from ground sources, roof vents, storm drain structures, etc. All sources of Rainfall Dependent Infiltration/Inflow will be photographed, measured, drawn, and documented accordingly with addresses, data, and sketches. The smoke test form will identify which sewer segment is being tested by its component identification in the city's GIS database.
11. All defects encountered will also be recorded using handheld tablets 'blue tooth' to a GPS receiver. The tablet will have access to the city's wastewater collection system GIS which will be overlaid on a digital ortho map and the GPS unit will allow the smoke test team member to see his location on the map in real time and allow for the accurate recording of a defect's type and location. Each defect image taken will be geocoded to a specific location and the information will be stored electronically for future use.

It is understood that the city staff members may accompany the selected Contractor's field staff during the smoke testing initiative to gain a better understanding of how to quantify potential inflow volumes from the smoke defects recorded and how to compare the smoke testing defect results to the previously recorded flow data. It is further understood that the selected Contractor's staff will install cleanout plugs and storm water manhole inflow dishes (provided by the city) concurrently with the smoke testing operations. The selected Contractor will develop a 'Smoke Testing Results' spreadsheet that identifies each pipe section tested and the results of the test, whether positive or negative. A separate spreadsheet: 'Smoke Testing Defects', will be prepared that identifies all defects encountered during the smoke testing activity. This spreadsheet will contain a column which identifies the surface area associated with each defect, and if there is a need to conduct dye water testing/flooding.

406-3. DYE INVESTIGATION

The results of the smoke testing may not always clearly or positively indicate the source of a sanitary sewer interconnection or defect. Further investigation may be required to fully define the I/I sources or defects under the following conditions:

1. Smoke injected into the sanitary sewer is seen in storm sewer catch basins. This may be caused by defective catch basin laterals in the vicinity of the sanitary sewer (if the sanitary sewer has open joints, cracks or breaks). Dye testing may be needed to determine if the catch basin is connected to the sanitary sewer. CCTV (by others) of the sanitary sewer may be needed to identify the point of the smoke exfiltration.
2. Smoke does not freely pass from one manhole to the next, or vent from property's roof stack/ roof plumbing vent, during the sanitary sewer smoke testing. CCTV (by others) of the sanitary sewer/lateral may be needed to identify sewer blockages or pipe sags.

Upon completion of the initial smoke testing within a service area, the selected Contractor will submit a list of locations that require further investigation to the city. Upon approval from the city, the city may request the selected contractor to accompany a city diagnostic crew to further investigate the inconclusive smoke test results. Techniques employed by the city may include dye testing, CCTV inspections (by others) manhole/catch basin inspection, sewer line lamping (by others), and storm sewer cleaning (by others).

Where initial smoke test results warrant further investigation as approved by the city, a non-toxic dye approved by the city will be used to investigate specific potential interconnections. Contractor shall submit the SDS for all dyes used. Storm sewer cross-connections and area drains that are suspected of being connected to the sanitary sewer will be positively identified using the dye tracer procedure. Laterals suspected of having significant leaks or breaks will also be investigated. Field documentation, including sketches showing the location of all tests conducted and digital photographs, where feasible, will be used to record findings. Internal pipeline inspection will determine the exact source of the suspected interconnection and establish the best abatement option. The following identifies the dye water protocols to be implemented.

406-3.1. DYE WATER TRACING

Private/Public sector dye water tracing will be conducted by introducing a small quantity of liquid dye concentrate into suspect sources such as downspouts, area drains, patio drains, window well drains, and driveway drains, and then introducing a sufficient volume of clean water to locate the source's discharge point. During each tracing, sanitary sewers, storm drains, and curb lines located downstream of the sources shall be monitored for signs of dyed water. The quantity of dye concentrate and water used will vary depending on pipe size and the quantity of flow and debris in each line section. A report will be prepared for each location where dye water tracing has been performed. The report will identify where the dye water was introduced and its' susceptibility for entering the wastewater collection system. Photos will be taken of where the dye water is introduced and where it is recorded discharging into the downstream wastewater collection system manhole. CCTV inspection equipment (by others) will be utilized to identify exactly where the dye water is entering the wastewater collection system piping.

406-3.2. DYE WATER FLOODING

Dye water flooding results will be documented for each location where the storm drainage system is flooded. Each dye water flood report will identify the section of wastewater gravity piping being tested, the location(s) where the storm water system piping was isolated and flooded, photographs of each setup and CCTV inspection results (by others) identifying the location(s) where dye water was identified entering the wastewater collection system. The following information will also be documented; evidence of dyed water in manholes downstream from the ponding area, stream crossing, or other suspected sources where the dyed water is placed, and time of travel from contributing source to the manhole sampled, and the concentration of the dyed water observed;

The Field Inspection Procedures for Dyed Water Flooding are as follows:

1. A mixture of water and any approved dye coloring substance will be introduced to the identified source. Dye water team inspectors will be stationed immediately downstream on the local sanitary and storm sewer lines. Observations, whether positive or negative, will be documented appropriately. Whenever possible the dyed water point of exit will be documented by CCTV inspection equipment (by others).
2. Prior to any dye testing, the appropriate city staff shall be notified of the specific location of testing and what adjacent waterways may be affected when the dye water is released into the storm drainage system.

Fire hydrants used to supply the water source needed will be opened slowly and closed in the same manner. A flow restrictive device shall be used on the hydrant to prevent discoloration problems. Should the water be running cloudy or dirty after use, the fire hydrant shall be left open at a slow pace until the water clears. If long term draining is required, the Dye Water Team shall notify the city.

406-4. MEASUREMENT AND PAYMENT

Measurement shall be the number of linear feet smoke tested and each occurrence of dye water tracing and dye water flooding.

406-5. BASIS OF PAYMENT

Payment shall be based upon the unit price per linear foot for smoke testing as measured above and each occurrence of dye water tracing and dye water flooding, which shall be full compensation for all work described in this section of the specifications and shall include all materials, equipment, and labor necessary to perform the smoke and dye testing.

500 SERIES: POTABLE AND RECLAIMED WATER MAINS, FIRE LINES AND APPURTENANCES

501. SCOPE

The Contractor shall furnish all plant, labor, materials, and equipment to perform all operations in connection with the construction of potable water mains, fire lines, reclaimed water mains and appurtenances including clearing, excavation, trenching, backfilling and clean up. All materials identified and specified in this section shall be NSF 61 and ISO 9001 compliant.

502. MATERIALS

502-1. GENERAL

Materials, equipment, and supplies furnished and permanently incorporated into the project shall be of the best quality in every respect and shall be constructed and finished to high standards of workmanship. Materials shall be suitable for service intended, shall reflect modern design and engineering, and shall be fabricated in a first-class workmanlike manner. All materials, equipment and supplies shall be new and shall have not been in service at any time previous to installation, except as required in tests or incident to installation. Machined metal surfaces, exposed bearings and glands shall be protected against grit, dirt, chemical corrosion and other damaging effects during shipment and construction.

All materials shall be tested in accordance with the applicable Federal, ASTM or AWWA Specification and basis of rejection shall be as specified therein. Certified copies of the tests shall be submitted to the Engineer of Record with each shipment of materials.

Engineer of Record shall certify and submit all material test results to the city Project Manager within 10 calendar days of performing test(s).

502-2. PIPE MATERIALS AND FITTINGS

502-2.1. DUCTILE IRON PIPE

Ductile iron pipe shall conform to the requirements of ANSI/AWWA C151/ A21.51, latest revision. The minimum thickness class for underground pipe shall be Thickness Class 51 for 4-inch pipe or greater, 3” ductile iron water mains or service lines are not allowed, Thickness Class 50 for 6-inch through 12-inch pipe and Pressure Class 250 for 16-inch pipe and larger. Flanged pipe shall have a minimum thickness class of Class 53. Pipe thickness class or pressure class, wall thickness and working pressure shall conform to the following table:

Size	Thickness Class (TC) Pressure Class (PC)	Thickness (In.)	Rated Water Working Pressure (PSI)
4”	TC51	0.26	350
6”	TC50	0.25	350
8”	TC50	0.27	350
12”	TC50	0.31	350
16”	PC250	0.31	250
20”	PC250	0.33	250

24”	PC250	0.37	250
30”	PC250	0.42	250
36”	PC250	0.47	250

Pipe larger than 8-inches in diameter or pipes which are deeper than 10-feet shall be ductile iron only, for open cut installations. The City Engineer reserves the right to require the use of ductile iron in sizes 4-inch through 12-inch when needed due to laying conditions or usage.

Pipe shall have a minimum rated water working pressure of 250 psi and shall be furnished in laying lengths of 20 feet or less, unless specifically shown otherwise on the Drawings. All piping and fittings shall be new and unused, no refurbished piping or fittings shall be accepted.

Ductile iron pipe shall be used for all hydrant installations, large meter sets 3” or larger and for fire line installations from the main to the backflow preventer.

Fittings: Fittings for bends, tees, crosses, etc. from 4-inch through 36-inch in size installed on ductile iron pipe shall be either mechanical joint, restrained joint or flanged joint as indicated on the Drawings and shall have a minimum working pressure of 250 psi. Fittings shall be cast ductile iron and shall conform to ANSI/AWWA C110, ANSI/AWWA C111 and ANSI/AWWA C153, latest revisions for flanged and mechanical joint pipe. Fittings for compact ductile iron cast fittings in accordance with ANSI/AWWA C153/A 21.53, latest revision with mechanical joint bells or ductile iron cast fittings in accordance with ANSI/AWWA C110/A 21.10, latest revision with mechanical joint bells. Fittings shall be coated and lined as indicated on the Drawings, in the manner specified below for ductile iron pipe. The rubber gaskets for flanged, mechanical, and push-on joints shall be as described below.

The working pressure minimum rating shall be 350 psi for 4-inch to 24-inch fittings. Fittings larger than 24-inch shall be pressure rated to 250 psi minimum. Fittings shall be designed to withstand without bursting a hydrostatic test of three times the rated water working pressure. All fittings shall have a date code cast into the fitting in addition to the pressure rating and material code. Ductile iron fittings shall be coated and lined in accordance with requirements of ANSI/AWWA C104/A21.4. Mechanical joint glands shall be ductile iron in accordance with ANSI/AWWA C111/A 21.11. When reference is made to ANSI/AWWA Standards, the latest revisions shall apply. Only those fittings and accessories that are of domestic (USA) manufacture shall be acceptable.

Push-On Joints: Push-on-joints shall be used for straight pipe lengths only. No fittings with push-on-joints shall be allowed. Pipe using push-on joints shall be in strict accordance with AWWA C111 and ANSI A21.11, latest revision. Jointing materials shall be provided by the pipe manufacturer and installation shall be in strict accordance with the manufacturer's recommended practice. The gaskets for push-on pipe joints shall be made of EPDM rubber. Push-on joints shall be as listed in the *City of Clearwater Approved Products List,* or an equal approved by the city.

Mechanical Joints: Jointing materials for mechanical joints shall be provided by the pipe and fitting manufacturer. Materials assembly, bolting and gaskets shall be in strict accordance with ANSI/AWWA C111 and ANSI/AWWA C110/ A 21.10 and ANSI/AWWA C153/ A 21.53, latest revisions. Tee head bolts and nuts for underground mechanical joint ductile iron fittings shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel in accordance with ASTM A242, or an equal approved by the Engineer. The gaskets for mechanical joints shall be made of EPDM rubber.

Flanged Joints: Bolt circle and bolt holes for flanges shall be drilled and faced to match ANSI B16.1, Class 125, with any special drilling and tapping as required to insure correct alignment and bolting. All accessory hex-head bolts and nuts and full faced gaskets for each joint size shall be furnished as a flange accessory package.

1. Gaskets: Full face, Toruseal gaskets, or approved equal shall be used for flanged pipe connections. Gaskets shall be suitable for a water pressure of 350 psi at a temperature of 180F. The gaskets for flanged joints shall be made of EPDM rubber.
2. Bolts and Nuts for Flanges: Bolts and nuts for flanges shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to prevent galling during installation.
3. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange machine surfaces shall be coated with rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.

502-2.1.1. MANUFACTURED RESTRAINED JOINTS FOR DUCTILE IRON PIPE

Restrained Pipe Joints and Fittings: Thrust restraint for buried piping shall be provided by restrained joints. Concrete thrust blocks shall not be acceptable. Pipe joints and fittings shall be restrained in accordance with the Drawings and the requirements of this Specification. It is intended that, at a minimum, all fittings shall be restrained. In cases where the calculated required length of restrained pipe is not evenly divisible by nominal laying lengths of pipe, the total required length of restrained pipe shall be rounded up to the next closest nominal length that is evenly divisible by the standard laying length.

A. Manufactured Restrained Joints: Manufactured restrained joints shall be manufacturer's standard specifically modified push-on type joints with joint restraint provided by ductile iron retainer rings joined together by corrosion-resistant, high strength steel tee head bolts and nuts or with joint restraint provided by a welded-on retainer ring and a split flexible ring assembled behind the retainer ring. Gaskets for manufactured restrained pipe joints shall be made of EPDM rubber. Manufactured restrained joints shall be as listed as an equal approved by the city.
B. Gripping-Type Gasket Restraint: Gripping-type gaskets may be used for ductile iron pipe 12-inches in size and smaller, when approved by the city. This type of restrained joint shall be the manufacturer's standard push-on type joint with joint restraint provided by a specially designed gasket with high strength stainless steel gripping elements which have sharp teeth on its inner surface for gripping the spigot end of the pipe joint. The gripping type gasket shall be made of EPDM rubber. The gripping type gasket manufacturer’s joint restraint shall only be considered for use on pipe sizes from 4-inch to 12-inch. Gripping type gasket restraints shall be as listed in the *City of Clearwater Approved Products List,* or an equal approved by the city.
C. Manufactured restrained joint pipe and fittings shall be ductile iron only and shall comply with applicable portions of this Specification. Manufactured restrained joints shall be capable of deflection during assembly. Deflection shall not exceed 50 percent of the manufacturer's recommendations.
D. Tee head bolts and nuts for restrained joints shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel in accordance with ASTM A242, or an equal approved by the Engineer.

502-2.1.2. ALTERNATE MECHANICALLY RESTRAINED JOINTS FOR DI PIPE

Thrust restraint for buried piping shall be provided by restrained joints. Concrete thrust blocks shall not be acceptable. When prior approval is obtained from the Engineer, ductile iron pipe and fittings with mechanical joints or ductile iron pipe with push-on joints may be restrained using a follower gland or ring which includes a restraining mechanism. Joint restraints shall have a working pressure rating of 350 psi for 3-inch to 16-inch ductile iron pipe, 250 psi for 18-inch to 36-inch ductile iron pipe, with a minimum pressure

rating safety factor of 2 to 1. The restraint shall be accomplished by multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10.

502-2.1.2.1. Restraints for Ductile Iron Pipe with Mechanical Joint Fittings

Joint restraints for ductile iron pipe to mechanical joint fittings shall be MEGALUG Series 1100 restraints by EBAA Iron, or an approved equal listed in the *City of Clearwater Approved Products List*. When actuated during installation, the restraining device shall impart a multiple wedging action against the pipe wall, which increases resistance as internal pressure in the pipeline increases.

A. The restrained joint shall maintain flexibility after installation. Glands shall be manufactured of ductile iron conforming to ASTM A536 and restraining devices shall be of heat-treated ductile iron with a minimum hardness of 370 BHN. The gland shall have standard dimension and bolting patterns for mechanical joints conforming to ANSI/AWWA C111 and C153, latest revisions. The restraining wedges shall have twist-off nuts to insure proper torquing.
B. Tee head bolts and nuts shall be manufactured of corrosion-resistant, high strength, low alloy CORTEN steel in accordance with ASTM A242.
C. No other retainer gland type device will be acceptable. After installation prior to backfilling, all parts of the joint restraint system shall be coated with coal tar epoxy equal to Carboline Bitumastic No. 300-M.

502-2.1.2.2. Restraints for Ductile Iron Pipe with Push-on Joints

Joint restraints for ductile iron push-on pipe joints 4-inch to 36-inch shall be constructed of ductile iron conforming to ASTM A536 and shall have a working pressure for 350 psi for 4-inch to 16-inch and 250 psi for 18-inch and larger fittings. Restraint shall be accomplished by a wedge action restraint ring on the spigot joined to a split ductile iron ring behind the bell and the two rings connected by restraint rods and nuts. Torque limiting twist off nuts shall be used to ensure proper actuation of the restraining wedges. The restraints shall be MEGALUG® Series 1700 restraint harnesses as manufactured by EBAA Iron or an approved equal.

A. The restrained joint shall maintain flexibility after installation. Restraint rings shall be manufactured of ductile iron conforming to ASTM A536 and the ring restraining wedge devices shall be of heat-treated ductile iron with a minimum hardness of 370 BHN. The restraining wedges shall have twist-off nuts to insure proper torquing.
B. Restraint rods and nuts shall be manufactured of corrosion-resistant, high strength, low alloy CORTEN steel in accordance with ASTM A242.
C. No other restraint harness type device will be acceptable. After installation prior to backfilling, all parts of the joint restraint system shall be coated with coal tar epoxy equal to Carboline Bitumastic No. 300-M.

502-2.1.3. Ductile Iron Pipe Installed with Steel Casings

General: All pipe placed within steel casings shall be push-on joint ductile iron pipe restrained by the use of mechanical bell restraints as specified above in *Section 502-2.1.2.2*. The rods for the bell restraints shall be double nutted to prevent over-belling of the joint during push-in of the carrier pipe into the casing. The carrier pipe shall have properly sized casing spacers installed on the pipe so that the pipe will be centered within the casing. Each end of the casing shall be properly sealed to prevent the intrusion of soil, water, or debris within the casing itself. It shall be double sealed by brick and cement mortar and include a casing end seal with stainless steel bands as shown on in the engineering construction standards.

Cement-Mortar Interior Lining (Potable or Reclaimed Water): Ductile iron pipe, fittings, and specials shall be cement lined in accordance with ANSI/AWWA C104, latest edition, "Cement-Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water". The cement lining shall have standard thickness

and, after curing, the lining shall have a seal coat of bituminous material in accordance with ANSI/AWWA C104/A21.4 80, latest revision and shall be listed by ANSI/NSF Standard 61 for potable water contact.

Pipe Labeling: Pipe manufacturer shall label in large legible lettering on the exterior of the pipe the type of pipe interior lining.

Exterior Coatings for Buried Pipe: Ductile iron pipe, fittings, and specials to be installed underground shall be coated on the exterior at the factory with one coat, 1 mil DFT, of asphaltic coating per AWWA C151, C110 and C153. All clamps, bolts, nuts, studs, and other uncoated parts of joints for underground installation shall be coated with coal tar epoxy prior to backfilling. Coal tar epoxy shall be equal to Carboline Bitumastic No. 300-M.

Exterior Coating for Exposed Pipe: Ductile iron pipe, fittings, and specials to be installed aboveground shall be furnished with a shop applied primer on the exterior. All above ground ductile iron pipe and fitting installations shall be painted in the field with an epoxy-epoxy-urethane system coating from an approved coating manufacturer, color: Safety Blue for potable water, Pantone Purple for reclaimed water or Safety Green for wastewater.

502-2.1.4. POLYETHYLENE ENCASEMENT FOR BURIED DUCTILE IRON PIPE

Polyethylene tube encasement shall be provided and installed for all buried ductile iron pipe segments and fittings for corrosion protection as specified herein. Both material and installation procedures shall be in accordance with ANSI/AWWA C105/ A21.5-10. Polyethylene encasement material shall be manufactured with UV inhibitors. The polyethylene encasement shall be color coded as follows:

A. Potable Water Service – Blue Polyethylene Encasement.
B. Reclaimed Water Service – Pantone Purple Polyethylene Encasement.
C. Wastewater Service – Green Polyethylene Encasement.

The polyethylene encasement shall be a minimum of 8 mils thick and shall be certified by the manufacturer to provide suitable protection of pipe installation in corrosive soil.

All pipe joints shall consist of a minimum of one foot of polyethylene overlap onto the adjacent pipe at both ends. All overlap material shall be secured in place with at least two wraps of 1-inch wide x 8 mils thick polyethylene adhesive tape. Any slack liner material along the pipe barrel shall be taken up by folds secured in-place with adhesive tape. Repair any rips, punctures, or other damage to polyethylene with tape or by patching.

All valves, fittings and specialty items shall be jointed with proper overlaps and fastening as described above. Prepare openings for service taps, air-reliefs, etc., by making a cut in the polyethylene and temporarily folding back the edges. After installation is completed, replace the polyethylene and repair the cut with polyethylene adhesive tape.

Care shall be taken during backfilling so that no damage will occur to the polyethylene encasement. In general, backfilling shall be done in accordance with AWWA Standard C 600.

The Contractor shall install polyethylene encasement in accordance with all liner and pipe manufacturer recommendations.

Polyethylene encasement shall be required for below ground installations of ductile iron pipe and fittings where the installed ductile iron utility pipe will be located less than 10 feet from a gas main.

502-2.2. POLYVINYL CHLORIDE (PVC) PIPE

Each length of PVC pipe shall bear identification that will remain legible during normal handling, storage and installation such as the name or trademark of the manufacturer, the location of the manufacturing plant,

and the class or strength classification of the pipe. All PVC pipe shall bear the NSF-DW seal. Each length of pipe shall also bear and so designate the testing agency that verified the suitability of the pipe material for potable water service. The markings shall be plainly visible on the pipe barrel. This required identification shall be factory applied by the manufacturer. Pipe which is not marked clearly with the required identification is subject to rejection. All rejected pipe shall be promptly removed from the project site by the Contractor. PVC pipe is approved for underground installations only.

Polyvinyl Chloride (PVC) Pipe 4-inch through 8-inch shall be in accordance with ANSI/AWWA C900, DR18, latest revision and the American Society for Testing & Materials for the PVC Resin Compound conforming to ASTM Specification D1784. Pipe shall have gasketed integral bell ends and shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults. Pipe shall be designed for maximum working pressure of not less than 235 psi and with not less than a sustained hydrostatic pressure of 470 psi for a safety factor of 2 to 1 for AWWA C900 pipe.

Polyvinyl Chloride Pipe shall be manufactured to the same outside diameter (O.D.) as Ductile Iron Pipe only. Pipe larger than 8-inches in diameter or pipes which are deeper than 10-feet shall be ductile iron only. The City Engineer reserves the right to require the use of ductile iron in sizes 4-inch through 8-inch when needed due to laying conditions or usage.

Pipe dimension ratio, working pressure and laying length shall conform to the following table:

Size	Dimension Ratio (OD/Thick.)	Rated Water Working Pressure (PSI)	Laying Length (Ft)
4	18	235	20
6	18	235	20
8	18	235	20
12	18	235	20

Bell and Spigot Pipe Joints: Pipe joints shall be gasketed, push-on type made with integral bell and spigot pipe ends in accordance with ASTM D3139, latest revision. The bell shall consist of an integral thickened wall section designed to be at least as strong as the pipe wall. The bell shall be supplied with factory glued rubber ring gasket which conforms to the manufacturer's standard dimensions and tolerances. The gasket shall meet the requirements of ASTM F477 "*Elastomeric Seals (Gaskets) for Joining Plastic Pipe*" and shall be manufactured of EPDM elastomeric material. PVC pipe shall be approved by the Engineer and the Owner or approved equal.

Integral Pipe Color: All PVC pipe for potable water mains, reclaimed water mains and wastewater force mains shall be extruded or fabricated with an integral color in the PVC material. The integral color for the PVC pipe shall be as follows:

A. Potable Water: PVC pipeline color - Blue.
B. Reclaimed Water: PVC pipeline color – Pantone Purple
C. Wastewater: PVC pipeline color – Green

The use of white or any other color pipe for potable water, reclaimed water or wastewater service shall be prohibited.

Fittings: Fittings for PVC pressure pipe shall be ductile iron fittings with restrained mechanical joint ends, linings and coatings as specified in *Section 502-2.1* for ductile iron fittings.

Restrained Joints for PVC Pipe: Thrust restraint for buried piping shall be provided by restrained joints. Concrete thrust blocks shall not be acceptable. Thrust restraints shall be used at all valves, tees, bends, and other fittings for the Restrained Joint PVC pipe and Push-on Joint PVC pipe. Where indicated on the Drawings, to prevent pipe joints and fittings from separating under pressure, pipe joints and fittings for PVC pipe shall be restrained as follows:

A. PVC pipe bell and spigot push-on joints, adjacent to restrained fittings, shall be restrained using a harness type restraint device. The harness restraint shall be split to enable installation of the restraint after the spigot has been installed into the bell. The restraint unit shall consist of a split ring that fits behind the bell, a split restraint ring that installs on the spigot and a number of clamping bolts to connect the other two parts. The restraining device shall consist of multiple individually activated gripping wedges or a series of serrations to grip the pipe and maximize restraint capability in conjunction with a sufficient number of clamping bolts connecting the retainer on the bell side of the joint pipe to the restraint ring on the other side to hold the spigot. The restraining device and components shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 65-42-10. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel meeting the requirements of ASTM A242. The restraint device shall be the EBBA Iron MEGALUG® Series 1500 TD Restrainer or an equal.
B. Mechanical joint fittings used with PVC pipe shall be restrained with the EBBA Iron MEGALUG® Series 2000 PV Restrainer or an equal approved. The restraining device shall consist of a retainer gland such that it can replace the standard mechanical joint gland and can be used with the standard mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21-53. The restraining device shall have a pressure rating equal to that of the PVC pipe on which it is used. Twist off nuts, sized same as the tee-head bolts shall be used to insure proper actuating of restraining devices. The restraining gland shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 65-42-10. The tee head bolts and nuts, and the clamping bolts and nuts, shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel meeting the requirements of ASTM A242.

502-2.2.1. RESTRAINED JOINT PVC PIPE (DIRECTIONAL BORE)

Restrained Joint PVC pipe and couplings used for directional bores shall be made from un-plasticized PVC compounds having a minimum cell classification of 12454-B, as defined in ASTM D1784 (latest edition). All compounds shall qualify for a Hydrostatic Design Basis (HDB) rating of 4000 psi for water at 73.4°F, in accordance with the requirements of ASTM D2837 (latest edition latest edition). Blue pipe (safety blue paint color) shall be supplied for the potable water system and purple pipe (pantone 522C paint color) shall be supplied for the reclaimed water system as specified in *Section 502-2.2.*

Nominal outside diameters and wall thickness of PVC pipe shall conform to the requirements of AWWA C900 for pipe sizes between 4 and 16-inches. Nominal outside diameters and wall thickness of 4" PVC pipe shall conform to the requirements of ASTM D2241 (latest edition). PVC pipe shall be furnished in sizes 4" (Pressure Rating 250 psi, DR17), 4" (Class 305, DR-14) and 6" and 8" (Class 235, DR-18). Pipe shall be furnished in standard laying lengths of 20 ft. + 1 in.

PVC pipe used for directional bores shall be joined using a restrained-joint coupling system or ring restraint with Rieber Gasket meeting the requirements of ASTM F477, latest edition. Pipe and/or couplings shall be designed as an integral system and shall be provided by a single manufacturer for maximum reliability and interchangeability. Assembled joints shall meet the leakage test requirements of ASTM D3139 (latest edition). No external pipe-to-pipe restraining devices which clamp onto or otherwise damage the pipe surface as a result of point-loading shall be permitted.

Maximum allowable axial jacking loads for the pipe shall be provided by the pipe manufacturer. The Contractor shall provide and utilize appropriate instrumentation that the Engineer shall monitor, to ensure that the jacking loads never exceed 80% of the maximum allowable axial jacking loads allowed by the pipe manufacturer. Only experienced personnel shall be used to install pipe. If used, coupling edges shall be beveled to reduce drag force when pipe is installed by directional bore or Micro tunneling. Assembly of joints shall be in strict accordance with the manufacturer's written instructions.

Manufacturer/Product: Certain Teed Certa-Lok C-900, no approved equal.

502-2.3. HIGH DENSITY POLYETHYLENE (HDPE) PIPE

This Section includes materials and methods of installation of high-density polyethylene pipe (HDPE) and fittings for water, reclaimed water, and wastewater utility use as required and as specified herein. For point repairs only if the flow cannot be stopped the use of stiffeners is allowed.

The high density, very high molecular weight polyethylene pipe shall be made from a HDPE material having a minimum material designation code of PE4710 and shall conform to AWWA C906, latest revision. The material shall meet the requirements of ASTM D3350 and shall have a minimum cell classification of PE445574C/E. In addition, the pipe shall be listed as meeting NSF-61. HDPE pipe shall have outside diameter sizes matching ductile iron pipe (DIPS) and shall have the minimum wall thickness and dimension ratio (DR) as shown on the Drawings for a particular installation. Minimum pressure ratings for HDPE pipe shall be 250 psi DR 9 and 200 psi for DR-11. The DR rating or the minimum pipe wall thickness of the pipe for a particular HDD installation shall be as called out on the Drawings. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by pre-compounding in a concentration of not less than 2 percent.

The pipe manufacturer shall be listed and in good standing with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe. Pipe shall be manufactured by Performance Pipe (Chevron), JM Eagle or an approved equal.

HDPE pipe shall be manufactured and identified by color based on the type of utility service. HDPE pipe and tubing less than 6-inch in size shall be manufactured entirely in the required color. For HDPE pipe 6-inch and greater, color coding shall be accomplished either through an exterior surface entirely of the required color or through striping. The color coding shall be permanently co-extruded on the pipe exterior surface as part of the pipe's manufacturing process. The pipe shall be manufactured as one solid color per the applicable service color or shall be black in color with three (3) permanent solid color stripes, per the applicable service color, extruded into the piping material. The colored stripes shall appear on three (3) sides of the pipe, run the entire length of the pipe, and each stripe shall be no less than 1-inch wide. Painting HDPE pipe to accomplish color coding shall not be permitted. The pipe identification color coding based on the intended Type of Utility Service shall be as follows:

1. Sewer – green (safety green paint color)
2. Water – blue (safety blue paint color)
3. Reclaimed water – purple (pantone 522C paint color)

In addition to the identification color being co-extruded, HDPE Pipe shall have been continuously marked by the manufacturer with permanent printing with the following information at a minimum:

A. Nominal Size (Inches).
B. Dimension Ratio (DR).
C. Pressure Rating (psi).
D. Trade Name.
E. Material Classification (PE4710).
F. Plant, Extruder and Operator Codes.
G. Resin Supplier Code.
H. Date Produced; and
I. HDPE pipe used for potable water mains shall bear the NSF Seal of Approval.

502-2.3.1. MECHANICAL JOINT ADAPTERS (MJ ADPATERS)

Mechanical Joint Adapter Fittings shall have a material designation code of PE4710, and a minimum Cell Classification of PE445474C/E. Mechanical Joint Adapters can be made to ASTM D3261 or if machined, must meet the requirements of ASTM F2206. MJ Adapters shall have a pressure rating equal to the pipe

unless otherwise specified on the plans. Markings for molded or machined MJ Adapters shall be per ASTM D3261.

Where shown on the drawings, 4-inch and larger transitions to mechanical joint fittings and valves shall be ductile iron mechanical joint. Connection to the mechanical joint fittings shall be accomplished using a mechanical joint adapter kit. The mechanical joint adapter fitting shall be fused onto the pipe and shall result in a restrained joint with a pressure rating no less than 150 psi. The D.I./HDPE mechanical joint adaptor shall consist of:

1. A molded or fabricated HDPE mechanical joint transition fitting.
2. A mechanical joint rubber gasket fabricated of EPDM.
3. A mechanical joint restraining gland. The restraining gland shall be manufactured of high strength, ductile iron meeting ASTM A536, Grade 65-42-10.
4. The tee head bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel, meeting the requirements of ASTM A242.

502-2.3.2. BUTT FUSION PROCESS AND INSTALLATION

The pipe shall be joined by the butt fusion procedure outlined in ASTM F2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations and shall be butt-welded flush to the outside diameter of the pipe. Joints shall provide axial pullout resistance. Fusion joints shall be made by qualified fusion technicians per PPI TN-42. A record or certificate of training for the fusion operator must be provided to the Engineer that documents training to the fundamentals of ASTM F 2620.

All HDPE fusion equipment operators shall be qualified to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project and shall be certified by the pipe supplier/manufacturer. Training records for qualified fusion technicians shall be submitted to the Engineer for review. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.

When the fusion machine operator is employed by the HDPE pipe and fusion machine supplier, the supplier shall maintain an ISO 9001 Certified Quality Management System.

Sections of HDPE shall be joined into continuous lengths on the job site above ground and butt fused in strict accordance with pipe manufacturer's recommendations. The finished pipe assembly shall be pressure tested prior to insertion underground.

All HDPE pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with high density polyethylene pipe. The pipe supplier shall certify in writing to the Engineer that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be on site to oversee the pipe joining. Expenses for the representative shall be paid for by the Contractor.

The butt fused joint shall have a zero-leak rate under the following conditions:

A. External pressure up to 60 psi from bentonite injection, slurry system operation, or groundwater head.
B. Internal hydrostatic pressure testing of 150 psi.

The Contractor shall obtain from the pipe manufacturer a certificate of compliance to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. The Contractor shall submit these certificates to the Engineer prior to installation of the pipe materials. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid. Joints or fittings that do not conform to these

specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the city, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

Each joint fusion shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine. Joint data shall be submitted as part of the As-Built record information, in accordance with this Technical Specification.

Butt Fusion Machines: Only appropriately sized, and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following properties, including the following elements:

A. Heat Plate: Heat plates shall be in good condition with no deep gouges or scratches within the pipe circle being fused. Plates shall be clean and free of any contamination. Heater controls shall properly function, and cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's recommendations.
B. Carriage: Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
C. General Machine: Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
D. Data Logger: The current version of the pipe supplier's recommended and compatible software shall be used. Protective case shall be utilized for the hand-held wireless portion of the unit. Data Logger operations and maintenance manual shall always be with the unit. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.
E. Joint Recording: Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of thermoplastic pipe. The software shall register and/or record the parameters required by the manufacturer and these Specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

Required Auxiliary Equipment: Other equipment specifically required for the butt fusion process shall include the following:

A. Pipe rollers shall be used for support of pipe on either side of the fusion machine.
B. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement and /or windy weather.
C. Fusion machine operations and maintenance manual shall always be kept with the fusion machine.
D. Facing blades specifically designed for cutting HDPE pipe.

The pipe shall be installed in a manner that does not exceed 70 percent of the recommended maximum bending radius of the pipe. When the pipe is installed by pulling in tension, 75 percent of the recommended Safe Pulling Force, according to the pipe supplier, shall not be exceeded.

Joint Fusion Bead Removal: Contractor shall trim and remove the butt fusion beads from the inside and the outside of the HDPE pipe at the butt fused joint following joint fusing. without disrupting pipe service. The restraints shall be manufactured by EBAA Iron Series 1500 or 1600 or approved equal.

502-2.4. PIPING IDENTIFICATION SYSTEM

502-2.4.1. EXTERIOR MARKINGS FOR BURIED PIPE

All ductile iron and polyvinyl chloride pressure pipelines installed by open cut shall receive a color-coded continuous self-adhesive vinyl tape, installed by the contractor, with the width and located as indicated below. Pipe tape striping shall be in the color required for the service as specified below.

A. Tape Stripe Marking Locations:

Up to 4-inch diameter pipe	(1 location)	3-inch wide tape placed at center-top of pipe.
6 to 16-inch diameter pipe	(2 locations)	6-inch wide tape placed on both sides, top half of pipe.
20-inch and larger diameter pipe	(3 locations)	6-inch wide tape placed on both sides' top half of pipe with a third stripe centered along top of pipe.

B. Color of Tape Stripe Marking:

Potable Water Marking Stripe Tape	Blue with Black or White Lettering, "POTABLE WATER MAIN" or similar wording.
Reclaimed Water Marking Stripe Tape	Purple with White or Yellow Lettering, "RECLAIMED WATER MAIN" or similar wording
Force Main Marking Stripe Tape	Green with Black or White Lettering, "WASTEWATER FORCE MAIN" or similar wording

502-2.4.2. LOCATION DETECTION WIRE:

A. **Location Detection Wire for Open-Cut Pipeline Installations:** All ductile iron and polyvinyl chloride pressure pipelines installed by open cut shall be laid with two (2) strands of Location Detection Wire applied to the pipe. The detection wire shall be continuous, high strength copper clad steel (HS-CCS) 10 gauge AWG wire insulated with 30 mil thick high molecular weight – high density polyethylene (HMW-HDPE) insulation with a minimum break load of 684 pounds and specifically designed for use in open cut installations, equal to "1030-HS High Strength Tracer Wire" manufactured by Copperhead Industries, LLC, or an approved equal. Each wire shall be continuous with splices made only by spicing connectors manufactured by the wire manufacturer equal to "LSC1030C Snake Bite™ Locking Connectors" as manufactured by Copperhead Industries, LLC or an approved equal. The 2 wires shall be taped to the top of each joint of pipe with about 5-feet between each piece of tape, with a minimum of 3 taping locations for each 20-foot length of pipe. The tape used shall be 3M Scotch Rap All-Weather Corrosion Protection Tape, polyvinyl chloride backing with rubber adhesive, 4-inches wide or Engineer Approved Equal.

Following installation of the pipeline including backfill and compaction, the Contractor shall perform a second 12-volt DC electrical continuity test on each of the two (2) tracer wires.

B. **Location Detection Wire for Horizontal Directional Drilling Pipeline Installations:** All polyvinyl chloride or HDPE pressure pipe installed by directional drilling methods shall be installed with three (3) insulated tracer wires. The three (3) tracer wires shall be attached at 120-degree locations around the pipe to help ensure continuity of at least one wire subsequent to the HDD installation. The tracer wire shall be continuous, extra high strength copper clad steel (EHS-CCS) 10 gauge AWG wire insulated with 45 mil thick high molecular weight – high density polyethylene (HMW-HDPE) insulation with a minimum break load of 2,032 pounds and specifically designed for use in directional drilling installations, equal to "1045-EHS Solo Shot EHS, Extra High Strength Tracer Wire" manufactured by Copperhead Industries, LLC, or an approved equal.

Continuity shall be maintained in the wire along the entire length of the pipe installed by HDD. No splices shall be allowed for each wire attached to the HDD pipeline unless approved by the city or the Engineer. If approved, permanent splices shall be made using wire connectors approved for underground applications with splices made only by spicing connectors manufactured by the wire manufacturer equal to "LSC1030C Snake Bite™ Locking Connectors" as manufactured by Copperhead Industries, LLC or an approved equal. If splices are approved by the city or the Engineer, all miscellaneous splicing components shall be furnished, installed, and tested by the Contractor and witnessed by the city or the Engineer.

At a minimum, the location detection wires shall be attached to the pipe with nylon wire ties, with ties located at 5-foot intervals, as shown in the Standard Details. The Contractor may suggest other methods of attachment, with the approval of the city or the Engineer.

Prior to installation of the pipeline into the bore hole, the Contractor shall perform a 12-volt DC electrical continuity test on each of the three (3) wires during the aboveground pressure test.

Following installation of the pipeline into the bore hole, the Contractor shall perform a second 12-volt DC electrical continuity test on each of the three (3) tracer wires. Failure of continuous continuity for at least one of the three tracing wires attached to the HDD pipeline, at the discretion of the city or the Engineer, shall be cause for rejection of the HDD installation, resulting in the abandonment and reinstallation of the directionally drilled pipeline.

The HDD tracer wires shall be spliced twelve (12) inches below grade to three (3) 10-gauge tracer wires, as specified above for open cut installations, and brought up in the valve boxes at the ends of each HDD line segment. The splices shall be made only by methods per the tracer wire manufacturer's recommendations and by splicing connections manufactured by the tracer wire manufacturer. The splicing connectors shall be the "LSC1030C SnakeBite™ Locking Connector" as manufactured by Copperhead Industries, LLC, the Direct Bury Lug as manufactured by DryConn®, or an approved equal.

C. **Color of Location Detection Wires:** The insulation color for the wire shall match the color for the pipes intended service as follows:
    1. Potable Water Mains – Blue Insulation.
    2. Reclaimed Water Mains - Pantone Purple Insulation.
    3. Wastewater Force Mains – Green Insulation.
D. **Termination of the Location Detection Wires:** The tracer wires shall be secured to all valves, tees and elbows. It is to be installed at every valve box through a 2-inch PVC pipe to 18-inches above the top of the concrete slab. The 2-inch PVC pipe shall be the same length as the adjustable valve box, and the 2-inch PVC pipe shall be plugged with a 2-inch removable brass plug with recessed square nut

502-2.4.3. WARNING TAPE:

In addition, all underground pipelines installed by open-cut methods shall be buried with identification tape installed over the centerline of the pipe at a depth of 1.0 foot below finished grade. The identification tape shall be as follows:

A. Identification tape shall be manufactured of reinforced polyethylene film with a minimum overall thickness of 4 mils and shall have a 0.35 mil thick magnetic metallic foil core. The tape shall be highly resistant to alkalis, acids, and other destructive agents found in soil. Tape width shall be 3-inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2-feet for entire length of tape. Tape shall be Terra Tape Sentry Line, or an approved equal.
B. Tape background colors and imprints shall be in accordance with the following table:

Tape Imprint	Background Color	Imprint Color
"Caution – Potable Water Main Buried Below"	Blue	Black

"Caution – Reclaimed Water Main Buried Below"	Purple	White
"Caution – Wastewater Force Main Buried Below"	Green	Black

502-2.5. RESTRAINED JOINT COUPLINGS

Restrained Joint Pipe Couplings: Restrained joint pipe couplings used to join and restrain two pieces of plain end pipe shall be sized to suit the outside diameter of the pipe ends to be jointed with restrained ends. Transition couplings shall be used to join pipes of different outside diameters. Pipe couplings shall be bolted type with ASTM A536 ductile iron middle ring and end followers.

Coatings: All ductile iron parts of the coupling shall be coated on the interior and exterior with a fusion bonded thermosetting epoxy coating, applied electrostatically prior to assembly, and complying with AWWA C550 with a 12-mil nominal coating thickness. The coating shall be equal to Mega-Bond as manufactured by EBBA Iron, Inc., or an approved equal.

Gaskets: Gaskets for the coupling shall be wedge type manufactured of EPDM resilient rubber.

Bolts: Torque limiting nuts and gripping restraint wedges shall be manufactured of corrosion resistant, low alloy, high strength steel. Threaded restraint rods and hexagonal nuts shall be manufactured of high strength, Type 316 stainless steel. Bolts and nuts shall conform dimensionally to ANSI/AWWA C111, latest revision.

Approved Manufacturer: Restrained joint couplings shall be Series 3800 as manufactured by EBBA Iron, Inc., or an approved equal.

502-3. GATE VALVES

General: Gate valves shall open by turning to the left (counterclockwise), when viewed from the stem. When fully open, gate valves shall have a clear, unobstructed waterway equal to the nominal diameter of the pipe. All internal valve components shall be removable from the valve bonnet without removing the valve body from the pressure main. Operating nut or hand wheel shall have an arrow cast in the metal indicating the direction of opening. Each valve shall have the manufacturer's distinctive marking, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by applying to it a hydrostatic pressure equal to twice the specified working pressure. Hydrostatic and leakage tests shall be conducted in strict accordance with ANSI/AWWA C500 or ANSI/AWWA C509, latest revisions, whichever is applicable. Only gate valve sizes 4-inch and larger shall be acceptable.

Large Gate Valves: Gate valves with nominal sizes from 4- to 12-inches shall conform to ANSI/AWWA C509, latest revision, and shall be designed for a minimum working pressure of 250 psi differential pressure with zero leakage. Gate valves with nominal sizes from 16- to 36-inches shall conform to AWWA C515, latest revision, and shall be designed for a working pressure of 250 psi differential pressure with zero leakage. Valves shall be ductile iron body resilient wedge type with Nitrile rubber O-ring stem seals. Stems shall be sealed with three (3) O-rings. The top two O-rings shall be replaceable with the valve fully open and subject to the full rated working pressure. O-rings in a cartridge shall not be allowed.

All cast ferrous components of the gate valve including the valve body, wedge, bonnet and stuffing box shall be constructed of ductile iron in conformance with ASTM A536. The valve stem shall be manufactured of manganese bronze in accordance with ASTM B763 and the wedge nut shall be manufactured of bronze in accordance with ASTM B584. The valve stem shall have an integral thrust collar; two-piece stem collars shall not be acceptable. The valve shall have Delrin thrust washers above and below the thrust collar to assist in the operation of the valve.

Valve wedge shall be symmetrical and constructed to assure uniform seating pressure between the wedge seat circumference and body seating surface, providing a complete seal at the rated pressure with flow from either direction. Resilient wedge of the valve shall be formed by a special corrosion and chloramine

resistant, EPDM synthetic elastomer which is permanently bonded to and completely encapsulates the ductile iron valve disc. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment.

All bolting materials for buried gate valves shall be Type 304 stainless steel with hexagonal shaped heads with dimensions conforming to ANSI B18.2.1; metric bolting materials shall not be allowed. Gate valves shall be NSF 61 listed.

Resilient wedge type gate valves shall be as listed in the *City of Clearwater Approved Products List,* or an equal approved by the city.

Valve End Joints: All gate valves shall have either mechanical joints per ANSI/AWWA C111/A21.11 or restrained joints as specified above for ductile iron or PVC pipe for underground service, or flanged ends, Class 125 per ANSI B16.1, for above ground service or valves in vaults to fit the pipe run in which they are to be used. Gate valves installed on push-on joint pipe shall have mechanical joint ends unless otherwise specified.

Gate Valve Operators: Unless otherwise shown on the Drawings or specified herein, gate valves shall have non-rising stems. Buried gate valves shall be furnished with a 2-inch square AWWA standard nut operator with a valve box and cover. All buried gate valves shall be installed in the vertical position only. Buried gate valves 16-inches and larger in nominal size installed vertically shall be provided with a spur gear box, valve operator. The spur gear shall be an EXEECO 1S-5 to IS-10 spur gear, depending on the valve size, with a gear ratio not more than 2:1. Gate valves located aboveground or inside structures shall be furnished with a rising stem and a handwheel operator which shall have an arrow cast in the metal indicating the direction of opening. Gate valves used as isolation valves for double check valve backflow preventers for fire lines or reduced pressure back flow preventers shall be of the open screw and yoke (OS&Y) design with rising stems and with a handwheel operator.

Gate valves larger than 16-inches in nominal size shall be provided with a smaller gate valve bypass sized by the gate valve manufacturer.

Interior Valve Lining: Interior of the valve body shall be lined with a fusion bonded or thermo-setting epoxy coating in accordance with AWWA C550, latest revision. Lining shall be holiday-free, NSF 61 approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before lining.

Exterior Valve Coatings: All exterior surfaces of iron body gate valves shall be clean, dry, and free from rust and grease before coating. For buried service, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Prior to back filling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with coal tar epoxy equal to Carboline Bitumastic No. 300-M. For valves installed above-ground, the exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness of 4 mils, of a rust-inhibitive universal epoxy primer. Primer shall be suitable for finish paint specified. Following installation, above-ground valves shall be finish painted in accordance with city Construction Standards.

Two Inch (2”) diameter gate valves or smaller are not allowed. These should be approved ball valves.

Three Inch (3”) diameter valves are not allowed.

502-4. VALVE BOXES

Furnish, assemble, and place a valve box over the operating nut for each buried valve. The valve box shall be designed to prevent the transmission of surface loads directly to the valve or piping.

Valve boxes shall be of the adjustable screw-type of suitable length with an interior diameter of not less than 5-1/4 inches. The valve boxes shall be manufactured of cast iron and shall be of the three-piece design

including a bottom section, middle section and top section with cover. The bottom section shall have a flange at the bottom having sufficient bearing area to prevent settling. The cast iron cover shall be cast with the applicable service; “WATER”, markings for potable water mains, “RECLAIMED” marking for reclaimed water mains or "SEWER", markings for wastewater force mains. The top section shall be adjustable for elevation and shall be set to allow equal movement above and below finished grade.

The castings shall be manufactured of clean, even grain, gray cast iron conforming to ASTM A48, Class 30B for Gray Iron Castings; and shall be smooth, true to pattern, free from blow holes, sand holes, projections, and other harmful defects. The seating surfaces of both the cover and the top section shall be machined so that the cover will not rock after it has been seated.

The valve boxes shall be coated inside and outside with an asphaltic coating prior to machining, so that the machined seating surfaces will be free of any coating. Valve extension stems shall be provided for all buried valves when the valve operating nut is deeper than 3 feet below final grade.

Valve boxes and their installation shall be included in the bid price for valves. Refer to *City Standard Detail Index 402; Sheet 1 of 3 & Sheet 2 of 3* for potable water valve pad detail, and *City Standard Detail Index 502; Sheet 1 of 3 & Sheet 2 of 3* for reclaimed water valve boxes and pad detail.

502-5. HYDRANTS

Fire hydrants shall be dry barrel, break away type with 5-1/4-inch minimum main valve opening and shall comply with AWWA C502, latest revision, for a 150-psi working pressure and shall also be UL/FM listed. All hydrants shall be hydrostatically tested at the factory in accordance with AWWA C502, latest revision. Hydrants shall be the compression type, closing with line pressure. The main valve shall be solid encapsulated EPDM rubber. The main valve stem shall be Type 304 or higher-grade stainless steel and manufactured in two sections with a breakable coupling. The main hydrant valve shall open left (counterclockwise). Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be threaded bronze and shall screw into a bronze retainer insert in the hydrant shoe, with O-rings to seal the barrel from leakage of water in the shoe. All interior working parts of the hydrant, including the seat ring, shall be removable through the top of the hydrant to allow repairs without disturbing the barrel of the hydrant after it has been installed. A dirt shield shall be provided to protect the operating mechanism from grit buildup and corrosion due to moisture. A thrust washer shall be supplied between the operating nut and stem lock nut to facilitate operation. The hydrant operating nut shall be of one-piece bronze or ductile iron construction and open counterclockwise. Operating nut shall be a No. 7, 1-1/2-inch, pentagonal shaped nut. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir.

Fire hydrants shall be the traffic model breakaway type, with the barrel made in at least two sections bolted together, of ample length for 3-1/2 foot depth of bury with necessary extensions to place the safety break flange located approximately 2-inches above finished grade. Breakaway bolts shall not be approved. The fire hydrant shall be provided with a 6-inch mechanical joint epoxy lined elbow. The hydrant shall be provided with two, 2-1/2-inch hose nozzles and one, 4-1/2-inch pumper nozzle, all having National Standard hose threads. All nozzles shall have caps attached by stainless steel chains. Hose nozzle cap nuts shall be 1-1/2-inch AWWA standard pentagonal shape. Nozzles shall be of the tamper resistant, 1/4-turn type with O-ring seals or threaded into upper barrel. Nozzles shall be retained with a stainless-steel locking device.

The hydrant shall be cast with no drain or weep holes or the drain or weep holes shall be permanently plugged by the manufacturer. All bolts, nuts and studs for fire hydrants shall be Type 316 stainless steel. Fire hydrant base, lower barrel and 6-inch elbow shall be epoxy coated inside and outside. Upper barrel shall have an interior epoxy coating with the exterior coated with an epoxy primer and a two-part

polyurethane top coating. Fire hydrant upper barrel exterior colors shall have National Standard Yellow, UV resistant enamel, polyurethane, or fusion bonded epoxy.

Approved Fire Hydrants: Only those fire hydrants listed in the *City of Clearwater Approved Products List*, shall be used in extension to or replacement of the city's potable water system: Absolutely no substitutions for fire hydrants shall be allowed without the approval of the city Engineering Department.

All shipments of fire hydrants to the project site shall be palletized, securely anchored to the pallet(s) and delivered by delivery trucks with mechanical, motorized tailgates for receipt by the Contractor.

All hydrant assemblies shall be provided with an auxiliary 6-inch resilient seated gate valve for isolation so that the water to the hydrant may be shut off without the necessity of closing any other valve in the distribution system. Gate valves for fire hydrant installations shall be as specified above in *Section 502-2.7*. Piping used from the water main tee to the fire hydrant shall be 6-inch ductile iron pipe only. Ductile iron pipe shall be in accordance with *Section 502-2.1*.

The fire hydrant assembly shall be provided with anchoring hydrant fittings including a locked hydrant tee with split gland to provide the locking together of the entire assembly for joint restraint. Hydrants shall be restrained by using bolted mechanical swivel-type connecting joints from the hydrant tee through to the hydrant. Restraining mechanical joint glands on hydrants shall be used only where hydrant runout length precludes the use of swivel joint connectors. Restrained joints shall absorb all thrust and prevent movement of the hydrant. If used, mechanical restrained joints shall comply with *Section 502-2.1.2* of these Technical Specifications.

All fire hydrants shall be provided with a fiber mesh reinforced concrete shear pad with dimensions as shown in the Drawings.

Fire hydrants shall be located in the general location as shown on the Drawings. Final field location of all hydrants shall be as required by the city. All hydrants shall be located no less than 6-feet and no more than 10-feet from the curb or edge of pavement of the adjacent roadway.

Fire hydrants shall be located in a manner to provide complete accessibility and separated from any and all obstructions such as utility poles, posts, walls, etc., by a distance of at least five feet, measured from the centerline of the fire hydrant to the nearest physical feature, which may obstruct access or view of any fire hydrant, unless otherwise required by the Owner. All fire hydrants located within FDOT rights-of-way shall conform to FDOT clear zone requirements.

In order to minimize any inconvenience to property owners, new fire hydrants shall be installed at or near side property lines. Fire hydrants shall be installed such that the 4-1/2-inch pumper nozzle faces the street or driveway, unless otherwise directed by the Fire Department or the Owner's representative.

No hydrants shall be installed on the reclaimed water system unless approved by the city Engineering Department.

502-6. SERVICE SADDLES/ POLYETHYLENE SERVICE LINES

Service Saddles: Service saddles shall have ductile iron bodies in accordance with ASTM A536, latest revision, with double stainless-steel straps. Ductile iron body shall have a fusion bonded nylon coating with a minimum thickness of 12 mils. Straps shall be Type 304 stainless steel with premium grade Type 304 L stainless steel bolts and Type 304 stainless steel washers and nuts. The nuts shall be Teflon coated. The gasket material shall be an EPDM elastomeric compound resistant to degradation by oil, natural gas, acids, alkalis, most aliphatic fluids, and chloramines. The outlet of the saddle shall have female NPT threads. Approved service saddles shall be as listed in the *City of Clearwater Approved Products List,* or an equal approved by the city.

Service saddles shall be used on all service taps on water main pipelines 4-inch in size and larger. The largest service connection allowable for a 4-inch main shall be a 1-1/2-inch tapped connection. Service saddles shall be used on all 2-inch service connections on water main pipelines 6-inch and larger. Taps larger than 2-inch in size shall require using a tapping sleeve as specified below in *Section 502-12*.

Corporation Stops: Corporation stops shall be all bronze bodies with an all bronze ball and Teflon seats, in accordance with AWWA C800. Inlet and outlet threads shall have NPT threads. Corporation stops shall be as listed in the *City of Clearwater Approved Products List,* or an equal approved by the city.

Polyethylene Service Lines: All polyethylene service lines require stiffeners must be approved by the city and manufactured by Mars Company, Ocala, FL 34483. 3" service lines are not allowed. Refer to reclaimed water *Standard Detail Index 501 Sheet 2 of 2*.

502-7. BACKFLOW PREVENTERS

The city owns and maintains all backflow prevention devices that are installed within their system. Therefore, any and all devices must be purchased from the city and installed by city work forces.

Backflow prevention devices that are installed on customer's service lines at the point of delivery (service connection) shall be of a type in accordance with AWWA C511, latest edition for Reduced Pressure Principle Backflow Prevention Devices or AWWA C506, latest edition for Double Check Valve Assembly Backflow Prevention Devices.

Two (2) different types of backflow prevention devices are allowed. The type of device, and when required, shall be determined by the degree of hazard presented to the municipal water system from possible backflow of water within the customer's private system, as determined by the city Utility Engineering Department. The two types of backflow prevention devices allowed are:

1. **Double Check Valve Assembly Backflow Prevention Device:** a device composed of two (2) single, independently acting, approved check valves, including tightly closing shutoff valves located at each end of the assembly and suitable connections for testing the water tightness of each check valve.
2. **Reduced pressure principle backflow prevention device:** a device containing a minimum of two (2) independently acting, approved check valves, together with an automatically operated pressure differential relief valve located between the two check valves. The unit must include tightly closing shutoff valves located at each end of the device, and each device shall be fitted with properly located test cocks.
    a. Reduced-pressure principle back flow preventers shall include an integral sensing system that will automatically open a relief valve whenever the differential pressure between the inlet supply and the reduced pressure zone drops to 2 psi. The relief valve shall remain open until a positive pressure differential of 2 psi is re-established. If pressure upstream of the first check valve drops to atmospheric or below, the relief valve shall remain fully open providing an internal air gap between the first check valve and the water level in the reduced pressure zone. The unit shall also be constructed such that any minor leakage of the second check valve will result in visible flow from the relief valve, even if the first check valve is totally disabled.

502-8. TAPPING SLEEVES AND LINESTOPS

Tapping valves and tapping sleeves shall be installed where shown on the drawings to make "wet" taps into existing potable water, reclaimed water mains or wastewater force mains. Tapping valves shall only be installed in the vertical position.

Tapping Sleeves for Taps 4-inch to 12-inch in Size: Fabricated all stainless steel body tapping sleeves to tap pipelines 4-inch through 30-inch in size with outlet tap sizes ranging from 4-inches through 12-inches, shall have heavy welded ASTM A240, Type 304 stainless steel body; Type 304 stainless steel bolts, Grade 8 per ASTM A194, epoxy coated; Type 304 stainless steel nuts, Grade 8 per ASTM A194, fluoropolymer coated; and a 3/4-inch Type 304 stainless steel test plug. The tapping sleeve, unless otherwise specified shall have a 18-8 Type 304 stainless steel outlet flange which meets the requirements of ANSI/AWWA C228 Class SD, ANSI 150 LB drilling recessed for tapping valve per MSS-SP60. The tapping sleeve gasket shall be EPDM rubber. Stainless steel body tapping sleeves shall be as listed in the *City of Clearwater Approved Products List,* or an equal approved by the city.

Mechanical Tapping Sleeves for Taps Larger Than 12-inch in Size: Mechanical joint split tapping sleeves shall be ductile iron capable of withstanding a 250-psi working pressure or the pipe rated working pressure, whichever is greater. The tapping flange for the sleeve shall have a groove that shall mate to the raised lip on the tapping valve flange. Gaskets shall be vulcanized EPDM resilient rubber material. All tapping connections for "size on size" taps shall utilize mechanical joint tapping sleeves only. The tapping sleeve shall be provided by the same manufacturer as the tapping valve. Bolts and nuts for the tapping sleeve split flange connection shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall be fluoropolymer coated and have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to prevent galling during installation. All interior and exterior surfaces of the mechanical joint split tapping sleeves shall be clean, dry, and free from rust and grease before coating. The interior and exterior surfaces of all mechanical joint split tapping sleeves shall be coated at the factory with fusion bonded or thermo-setting epoxy coating with a minimum total finish dry film thickness of 16 mils.

Tapping Valves: Tapping valves are special gate valves designed to mate to the flange of a mechanical tapping sleeve with a mechanical joint outlet connection. The tapping flange of the valve shall have a raised lip that will mate with the grooved flange of the tapping sleeve flange. The tapping valve shall have an oversized diameter waterway to allow passage of the tapping machine cutter assembly, without sustaining damage to the valve. Each tapping valve shall have the manufacturer's distinctive marking, pressure rating, the words" Ductile Iron" or "DI", and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by applying to it a hydrostatic pressure equal to twice the specified working pressure. Hydrostatic and leakage tests shall be conducted in strict accordance with ANSI/AWWA C509, latest revision. Resilient-seated type tapping valves shall be as listed in the *City of Clearwater Approved Products List,* or an equal approved by the city.

A. Tapping valves with nominal sizes from 4- to 12-inches shall conform to ANSI/AWWA C509, latest revision, and shall be designed for a minimum working pressure of 250 psi. Tapping valves with nominal sizes from 16 inches and larger shall conform to AWWA C515, latest revision, and shall be designed for a working pressure of 250 psi. Valves shall be ductile iron body, resilient wedge type with Nitrile rubber O-ring stem seals. Stems shall be sealed with three (3) O-rings. The top two O-rings shall be replaceable with the valve fully open and subject to the full rated working pressure. O-rings in a cartridge shall not be allowed. All cast ferrous components of the tapping valve including the valve body, wedge, bonnet and stuffing box shall be constructed of ductile iron in conformance with ASTM A536. The valve stem shall be manufactured of manganese bronze in accordance with ASTM B763 and the wedge nut shall be manufactured of bronze in accordance with ASTM B584. The valve stem shall have an integral thrust collar; two-piece stem collars shall not be acceptable. The valve shall have Delrin thrust washers above and below the thrust collar to assist in the operation of the valve. Valve wedge shall be symmetrical and constructed to assure uniform seating pressure between the wedge seat circumference and body seating surface, providing a complete seal at the rated pressure with flow from either direction. Resilient wedge of the valve shall be formed by a special corrosion and chloramine resistant, EPDM synthetic elastomer which is permanently bonded to and completely encapsulates the ductile iron valve disc.

The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment. All bolting materials for buried tapping valves shall be Type 316 stainless steel, as specified below, with hexagonal shaped heads with dimensions conforming to ANSI B18.2.1; metric bolting materials shall not be allowed. Tapping valves shall be NSF 61 listed.

B. **Tapping Valve Ends:** All tapping valves shall have a special flange with a raised lip to mate with the groove in the tapping sleeve flange and a mechanical joint end on the discharge side of the valve.

C. **Tapping Valve Connection Bolting:** Bolts and nuts for the tapping valve flange connection shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall be fluoropolymer coated and have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to prevent galling during installation. Jointing materials for the mechanical joint valve end and the mechanical joint tapping sleeve ends shall be in strict accordance with ANSI/AWWA C111 and ANSI/AWWA C153, latest revisions. Tee head bolts and nuts for the mechanical joint ends shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel in accordance with ASTM A242, or an equal approved by the Engineer and the Owner.

D. **Tapping Valve Operators:** Tapping gate valves shall have non-rising stems and shall open by turning to the left (counterclockwise), when viewed from the stem. Tapping valves shall be furnished with a ductile iron 2-inch square AWWA standard nut operator with an arrow cast into the metal indicating the direction of opening. Tapping valves 16-inches and larger in nominal size shall be provided with a spur gear box, valve operator. The spur gear shall be an EXEECO IS-5 to IS-10 spur gear, depending on valve size, with a gear ratio not more than 2:1.

E. **Interior Tapping Valve Linings:** The interior of the tapping valve body shall be lined with a fusion bonded or thermo-setting epoxy coating in accordance with AWWA C550, latest revision. Lining shall be holiday-free, NSF approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before lining.

F. **Exterior Tapping Valve Coatings:** All exterior surfaces of tapping valves shall be clean, dry, and free from rust and grease before coating. The exterior ferrous parts of all tapping valves shall be coated at the factory with fusion bonded or thermo-setting epoxy coating with a minimum total finish dry film thickness of 16 mils. Prior to back filling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with two coats of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

502-9. LINE STOPPING ASSEMBLIES

Specialty line stop fittings shall be used for applications where it is necessary to isolate a section of pipe without interrupting service. The Contractor shall provide a submittal which clearly identifies the materials used for line stop applications.

Sleeves used to line-stop existing mains shall be provided and installed at locations as shown on the Drawings or as required for construction of the new force main tie-in to an existing force main. Line-stopping sleeve shall be steel fusion epoxy coated body with stainless steel bolts, nuts, and washers. Contractor shall determine the outside diameter of the existing main prior to ordering sleeve. The back (bottom) section shall be solid and designed within an outside diameter range specific to the pipe it is being installed on. The front (top) section will also be full encirclement design with a welded installed nozzle and flange outlet.

Line stop fitting sleeves shall be the high strength type having a wide body, made of a minimum material strength of A-283 grade steel, ASTM A-36 Steel or equal, which conforms to and reinforces the pipe. The sleeve shall have as a minimum 7/8-inch wide gasket of Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000 with hydro activated lip, captured in a recessed groove around the outlet. Bolts, nuts and washers shall be 3/4-inch stainless steel 18-8 type 304. A 3/4-inch forged steel test outlet will be placed

into the nozzle branch outlet, at the factory, for the purposes of site pressure testing after the fitting has been installed around the pipe.

Tapping sleeves and line stops shall be installed in accordance with the manufacturer's recommendations for the specified model. The fitting may not be retrofitted in any way after being installed on the pipe. The Contractor shall be responsible for ensuring that the fitting is properly restrained.

The line-stopping equipment shall consist of a resilient sealing element, which shall be attached to and transported by a plug inserted perpendicularly into the pipe. The linear actuator shall extend and retract the Line-Stopper into and out of the pipe. When retracted from the pipe, the element and inserter shall be contained within the stopper housing.

The hollow cylindrical sealing element shall be molded of natural rubber. The lower interior chamber of the element shall be enlarged into a hemispherical cavity to allow symmetrical deformation into sealing conformity with the bore of the pipe. The linear actuator shall be hydraulic and shall have a self-contained hand operated pump. The actuator shall exert a force sufficient to perpendicularly deform the cylindrical element into axially symmetrical sealing contact with the bore of the pipe. Design of actuator shall provide adequate stroke and means to continually align the line-stop bullet stopping assemblies in sizes 4-inch thru 20-inch with pressure rating to 250 psig.

Equalization of pressure across the sealed element shall not be required to retract the element from the pipe. No equalization fittings shall be required downstream of the line-stopper.

Line-stopping equipment must be capable of function and acceptance of multiple stopper heads and shall be compatible with existing system fittings.

502-10. BLOW OFF HYDRANTS

Hydrant Blow offs are not allowed.

503. CONSTRUCTION

503-1. MATERIAL HANDLING

1. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be rolled off the carrier or dropped. Unloading shall be done by lifting with a forklift or crane using straps and a spreader bar. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.
2. Pipe shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes. Pipe shall be stacked no higher than 6-feet high on the project site for safety reasons. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, suitably spaced and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
3. The interior surfaces of valves and piping shall be kept free of dirt and debris.
4. Pipe and fittings which require the protection from UV, such as PVC or HDPE pipe, shall be covered and protected in accordance with manufacturer instructions.
5. Pipe shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at their expense in a manner satisfactory to the Engineer.

6. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
7. All materials shall be subject to inspection and approved by the Engineer after delivery; and no broken, cracked, misshapen, imperfectly coated or otherwise damaged, unsatisfactory or defective material shall be used.
8. All material found during the progress of the work to have cracks, flaws, or other defects shall be rejected and promptly removed from the site.
9. If damage occurs to any pipe, fittings, valves, hydrants or water main accessories in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items.

503-2. PIPE LAYING

503-2.1. INSPECTION PRIOR TO INSTALLATION

All pipe, fittings, valves, and other material shall be subject to inspection and approval by the Engineer and the City after delivery and prior to installation. If damage occurs to any pipe, fittings, valves, hydrants or accessories in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items. No broken, cracked, imperfectly coated, or otherwise damaged or unsatisfactory material shall be installed. When a defect or crack is discovered, the injured or defective piece shall not be installed and shall be removed from the project site. All homing marks shall be checked for proper length to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall result in rejection of pipe and removal from the site at the Contractor's expense.

503-2.2. GENERAL INSTALLATION REQUIREMENTS

General: Excavation, backfill, and compaction shall conform to the provisions of *Section 201-2. – Excavation, Backfilling and Compaction for Utilities*. Upon satisfactory installation of the pipe bedding material as specified in *Section 201-2. – Excavation, Backfilling and Compaction for Utilities*, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped in the trench.

Pipe, fittings, valves, and accessories shall be installed as shown or indicated on the Drawings. All joint lubricant compounds shall be NSF approved.

Water in Excavations: Water shall not be allowed in the trenches while underground pipes are being laid and/or tested. All pipe shall be laid “in the dry”. Installation of potable water pipes, reclaimed water pipes or wastewater force main pipes shall not proceed in the trench until the trench has been properly dewatered and prepared. Refer to *Section 203, Dewatering* for dewatering requirements for the installation of pipelines. No pipe shall be laid when, in the opinion of the Engineer, trench conditions are unsuitable. Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater the trench to the satisfaction of the Engineer or the city’s Inspector. The Contractor shall assume responsibility for legally disposing of all water so as not to injure or interfere with the normal drainage of the area in which he is working. In no case

shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately plugged during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken by the Contractor to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such materials have entered the pipelines, it must be cleaned as directed by the Engineer and the city's Inspector so that the entire system will be left clean and unobstructed. The Contractor shall not leave trenches open overnight.

Pipe Bedding: The Contractor shall provide pipe bedding material in accordance with the Standard Details on the Drawings and *Section 201-2. – Excavation, Backfilling and Compaction for Utilities*. The Contractor shall hand-grade bedding to proper grade ahead of pipe laying operation. Bedding shall provide a firm, unyielding support along the entire pipe length. If the trench has been excavated below the required depth for pipe bedding material placement, the Contractor shall fill the excess depth with pipe bedding material to the proper grade. The Contractor shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

Pipe Cradle: Upon satisfactory installation of the pipe trench as specified in *Section 201-2. – Excavation, Backfilling and Compaction for Utilities* and the pipe bedding, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging so that when the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints or pipe bell from the trench bottom.

Cleanliness: Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surface. The interior of the pipes shall be thoroughly cleaned of all foreign material before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other methods accepted by the Engineer and the city. During suspension of work for any reason at any time, a suitable watertight plug shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

Connections to Existing Utilities: All connections to existing piping systems shall be made as shown or indicated on the Drawings after consultation and cooperation with the city Utility Department. Some such connections may have to be made during off-peak hours (late night or early morning).

Pipe Joint Deflection: Whenever it is desirable to deflect pipe joints to avoid obstructions or to maintain required alignment, the amount of the joint deflection shall not exceed 50 percent of the maximum limits allowed by the pipe manufacturer for ductile iron pipe. No bending or joint deflection of PVC pipe shall be permitted at any time. Changes in horizontal and vertical alignment of PVC pipe shall be achieved by use of fittings only.

Pipe Installation: In preparation for pipe installation, placement (stringing) of pipe should be as close to the trench as practical on the opposite side of the trench from the excavated material.

All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling.

Pipe laying shall proceed with the bell ends of the pipe pointing in the direction of the work progress unless directed otherwise by the Engineer. Where pipe is laid on a grade of 10 percent or greater, the laying shall start at bottom and shall proceed upward with the bell ends of the pipe pointing upgrade. Before pipe is joined, gaskets shall be cleaned of all dirt and stones and other foreign material. The spigot ends of the pipe and/or pipe gaskets shall be lubricated lightly with an NSF approved lubricant as specified by the pipe manufacturer and approved by the Engineer and the city. No sulfur based joint compound shall be used. Sufficient pressure shall be applied to the pipe to properly seat the spigot end into the bell of the previously laid pipe. Any damage to the pipe due to over-exertion shall be repaired at the Contractor's expense All damaged pipe shall be removed for the Project site.

Pipe and fittings shall be laid accurately to the lines and grades indicated on Drawings or required. The depth of cover over the pipeline shall vary to provide uniform gradient or slope to the pipe, whether grading is completed or proposed at time of pipe installation. Where grades for the pipeline are not indicated on the Drawings, maintain a uniform depth of cover with respect to finish grade.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

All pipe laid shall be retained in position to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. Care shall be taken to ensure a good alignment both horizontally and vertically and to give the pipe a firm bearing along its entire length. Any pipe which has its grade or joint disturbed after laying shall be taken up and relayed.

All pipe and fittings shall be cleared of sand, dirt, and debris before laying. All precautions shall be taken to prevent sand, dirt, or other foreign material from entering the pipe during installation. If necessary, a heavy, tightly woven canvas bag of suitable size shall be placed over each end of the pipe before lowering into the trench and left there until the connection is made to the adjacent pipe. Any sand, dirt, or other foreign material that enters the pipe shall be removed from the pipe immediately. During pipe laying operations, no debris, tools, clothing or other materials shall be placed into the pipe interior. Interior of all pipe and fittings shall be kept clean after installation until accepted in the complete Work.

Any time that pipe installation is not in progress, the open ends of pipe shall be closed by a watertight plug or other method approved by the Engineer and the city Inspector. Plugs shall remain in pipe ends until all water is removed from the trench. No pipe shall be installed when trench conditions are unsuitable for such work, including standing water, excess mud, or rain.

Thrust Restraint:

A. General: Thrust restraint shall be accomplished by piping restrained joints or mechanical restraining devices.
B. Required Length of Restrained Joints: The length of restrained joints required shall be in accordance with the lengths shown on the Plan and Profile Drawings. The restrained joint lengths listed in the Restrained Joint Pipe Tables in the Drawings are absolute minimum lengths required and may not reflect the actual length of restrained joints required for a particular fitting arrangement or situation.
C. Concrete Trust Blocks: Concrete thrust blocks shall not under any circumstances be allowed on the Project for thrust restraint at fittings.
D. Concrete Trust Collars: Concrete thrust collars shall be used under extraordinary circumstances when approved by the Engineer and the city. If thrust collars are used, they shall conform to the details shown on the Drawings and shall be constructed of Class I concrete, which shall have a minimum compressive strength of 3,500 psi at 28 days. No pipeline work shall be accomplished adjacent to a thrust collar until the concrete has reached its full compressive strength and can handle the required thrust restraint.

Initial Backfill:

A. After pipe has been laid, inspected, and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place while conducting the preliminary hydrostatic test. No backfill shall be placed over the joints until the preliminary test is satisfactorily completed, leaving them exposed to view for the detection of visible leaks.
B. Upon satisfactory completion of the preliminary hydrostatic test, backfilling and compaction of the trench shall be completed.

Location Detection Wire: Refer to the city Standard Detail Drawings for wire location and installation notes. Location Detection Wires shall be installed for all potable water mains, reclaimed water mains and wastewater force mains. For open cut installation the two (2) detection wires shall be attached generally at the three o'clock and nine o'clock positions on the pipe with nylon pipe straps or tape located at 5-foot intervals for each 20-foot length of pipe. The wire shall be installed through valve boxes, valve vaults, air release valve enclosures, etc., and provide sufficient excess (12-inches minimum) such that a loop in the wire can be raised above ground level. An energy source shall be attached to each of the wires to energize each wire to facilitate location of the wire and pipe using a metal detector. Prior to acceptance, the Contractor shall demonstrate to the Engineer and the city Inspector that each of the wires is continuous and unbroken through the complete run of the pipe by performing a continuity test of the 10 gauge location detection wires for the entire length of the potable water main, the reclaimed water main or the wastewater force main at each valve test station box. The test shall also include energizing each of the wires and locating the entire run of pipe with the Engineer and the city Inspector present.

Underground Identification Tape: Install a continuous underground utility identification tape for all underground potable water mains, reclaimed water mains and wastewater force mains installed by open-cut methods. The identification tape shall be installed over the centerline of the pipe at a depth of 12-inches below finished grade.

Aboveground and Exposed Piping: Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings. Pipe connections shall be made in accordance with the details shown and manufacturer's recommendations. Open ends of pipelines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated or as required to ensure adequate support of the piping. All above ground piping shall be painted with the appropriate color.

503-2.3. INSTALLATION OF DUCTILE IRON PIPE

Handling and Cutting Pipe:

A. Care shall be taken in handling, cutting, and laying ductile iron pipe and fittings to avoid damaging the pipe and interior cement mortar lining, scratching, or marring machined surfaces, and abrasion of the exterior pipe coating. All cracked pipe and fittings shall be removed at once from the Work.
B. Pipe cutting shall be done by skilled workmen in a neat workmanlike manner without creating damage to the pipe and interior lining and to leave a smooth end at right angles to the axis of the pipe. Cut ends shall be square and rough edges of ductile iron pipe shall be ground smooth. For push-on joint connections, the cut end shall be beveled to prevent gasket damage during joint assembly. Interior lining and exterior coatings of the pipe shall be repaired at cut ends per the manufacturer's instructions prior to joint assembly.

Laying Ductile Iron Pipe and Fittings:

A. Bedding for Ductile Iron Pipe: Minimum bedding requirements shall be Type 3 as defined in ANSI/AWWA C600, latest revision. Provide proper bedding required, in accordance with thickness class of pipe being laid, restrained joints required and depth of cover. At a minimum the pipe shall be bedded in compacted 4-inch thick select fill and backfilled and compacted to the top of the pipe to a minimum of 95% Modified Proctor. Proper pipe laying conditions shall be in accordance with ANSI/AWWA C150 and C151, latest revisions, and ANSI/AWWA C600, latest revision.
B. All ductile iron pipe and fittings shall be laid in accordance with American Water Works Association Standard *ANSI/AWWA C600,* latest revision, entitled *"Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances"*, with the following sections specifically applying:

1. Section 3.3 - Pipe Installation.
2. Section 3.4 - Joint Assembly.

C. Polyethylene tube encasement shall be installed for all buried ductile iron pipe segments and fittings for corrosion protection. Installation procedures shall be in accordance with *AWWA C105/ANSI A21.5-10*, latest revision, entitled *Polyethylene Encasement for Ductile Iron Pipe Systems, Section 4.4 - Installation*.

Ductile Iron Pipe Joints:

A. General: The joints of all pipelines shall be made leak tight. The particular joint used shall be approved by the Engineer and the city Inspector prior to installation. Where shown on the Drawings or where, in the opinion of the Engineer or the city Inspector, settlement or vibration is likely to occur, all pipe joints shall be bolted mechanical joint type with mechanical restraints, push-on joints with mechanical restraints or manufactured restrained joint type as specified above, or as indicated on the Drawings.

All lumps, blisters, and excess coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid. Pipe joints shall be made up in accordance with the manufacturer's recommendations.

B. Mechanical Restrained Joints: All types of mechanical joint and push-on joint pipes with mechanical restraints shall be laid and jointed in full conformance with manufacturer's recommendations, which shall be submitted to the Engineer and the city Inspector for review and approval before work is begun. Only specially trained and skilled workmen shall be permitted to makeup mechanical restrained joints. Torque wrenches, set as specified in AWWA Standard C111, shall be used; or spanner type wrenches not longer than specified therein may be used with the permission of the Engineer and the city Inspector. The gasket shall be inserted, and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.
C. Manufactured Restrained Joints: Manufactured restrained joints shall be provided where indicated on the Drawings. Joint assembly shall be made in strict accordance with the manufacturer's instructions, which shall be submitted to the Engineer or the city Inspector for review and approval before commencing work.
D. Flanged Joints: Flanged joints shall be made up by inserting the gasket between the flanges. The threads of the bolts and the faces of the gaskets shall be coated with suitable lubricant immediately before installation. Joints shall be fitted so that the contact faces bear uniformly on the gasket.
    1. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing and lubricate bolts with oil and graphite.
    2. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
    3. Execute care when tightening joints to prevent undue strain upon valves, pumps, backflow preventers and other equipment.

If flanges leak under pressure testing, loosen, or remove the nuts and bolts, reset or replace the gasket, re-install or re-tighten the bolts and nuts, and re-test the joints. Joints shall be watertight; no leaks shall be allowed.

503-2.4. INSTALLATION OF POLYVINYL CHLORIDE (PVC) PIPE

Storage and Handling of PVC Pipe: PVC pipe shall be delivered to the site in unbroken bundles packaged in such manner as to provide protection against damage. When possible, pipe should be stored at the job site in the unit packages until ready for use. Packaged units shall be handled using a forklift or a spreader bar with fabric straps. Packaged units shall not be stacked at the job site higher than two units high.

When it is necessary to store PVC pipe for long periods of time, exposure to direct sunlight shall be prevented by covering the pipe with an opaque material. Adequate air circulation above and around the pipe shall be provided as required to prevent excessive heat accumulation. PVC pipe shall not be stored close to heat sources of hot objects such as heaters, fires, boilers, or engine exhaust. Pipe gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil, and grease. The interior and all sealing surfaces of pipe, fittings, and other appurtenances shall be kept clean and free of dirt and foreign matter.

Care shall be taken in handling and laying pipe and fittings to avoid severe impact blows, crushing, abrasion damage, gouging, or cutting. Pipe shall be lowered, not dropped, from trucks or into trenches. All cracked, damaged, or defective pipe and fittings, or any length of PVC pipe having a gouge, scratch, or other permanent indentation of more than 10 percent of the wall thickness in depth, shall be rejected and removed at once from the Work and replaced with new acceptable pipe.

Field Cutting PVC Pipe: Field cutting of pipe shall be done in a neat workmanlike manner without creating damage to the pipe. The pipe shall be cut square with a fine-toothed hand or power saw or other cutter or knife designed for use with plastic pipe. Prior to cutting, the pipe shall be marked around its entire circumference or a square-in vise shall be used to ensure the pipe end is cut square. Remove burrs by smoothing edges with a knife, file, or sandpaper.

Field Cutting Bell and Spigot PVC Pipe: Bevel the cut end of the pipe using a pipe beveling tool, wood rasp, or portable sander to prevent damage to the gasket during joint assembly. A factory-finished beveled end should be used as a guide to ensure proper beveling angle and correct depth of bevel. Round off any sharp edges on the leading edge of the bevel with a knife or file. The Contractor shall provide a seat homing mark on the field cut pipe in accordance with the pipe manufacturer's written instructions.

Laying PVC Bell and Spigot Pipe:

A. Pipe Bedding: Bedding for PVC pipe shall be as specified in *Section 201-2. – Excavation, Backfilling and Compaction for Utilities* using granular pipe bedding material.
B. All PVC pipe shall be laid in accordance with the pipe manufacturer's published installation guide, the *AWWA Manual of Practice No. M23 "PVC Pipe - Design and Installation"* and the Uni-Bell Plastic Pipe Association installation recommendations.

PVC Pipe Joint Assembly for Rubber Gasketed Bell and Spigot Pipe:

A. The PVC bell and spigot joint shall be assembled in accordance with the pipe manufacturer's installation instructions, ASTM D2774, and AWWA Manual M23. Clean the interior of the bell, the gasket, and the spigot of the pipe to be jointed with a rag to remove any dirt or foreign material before assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation.
B. Lubricate the spigot end of the pipe with an NSF approved lubricant supplied or specified by the pipe manufacturer for use with gasketed PVC pipe in potable water systems. The lubricant should be supplied as specified by the pipe manufacturer and shall be NSF approved. After the spigot end is lubricated, it must be kept clean and free of dirt and sand. If dirt and sand adhere to the lubricated end, the spigot must be wiped clean and re-lubricated.
C. Insert the spigot into the bell so that it contacts the gasket uniformly. Align the pipe sections and push the spigot end into the bell until the manufacturer's reference mark on the spigot is flush with the end of the bell. The pipe should be pushed into the bell using a bar and wood block. The joint shall not be assembled by "stabbing" or swinging the pipe into the bell, nor shall construction machinery be used to push the pipe into the bell. After joining the pipe, a metal feeler gauge shall be used to verify that the joint gasket is properly located.
D. If undue resistance to insertion of the spigot end is encountered or if the reference mark does not reach the flush position, disassemble the joint and check the position of the gasket. If the gasket is twisted or pushed out of its seat, inspect the components, repair, or replace damaged items, clean

the components, and repeat the assembly steps. Be sure the pipe is in proper alignment during assembly. If the gasket was not out of position, check the distance between the spigot end and the reference mark and relocate the mark if it is out of position.

E. Restrained joints for PVC pipe shall be provided where indicated on the Drawings. Joint assembly shall be made in strict accordance with the joint restraint manufacturer's instructions, which shall be submitted to the Engineer and the city for review and approval before commencing work.

503-2.5. DIRECTIONAL BORING INSTALLATION

The work of this Section includes all labor, machinery, construction equipment and appliances required for installation of high-density polyethylene (HDPE) pipe or Certa-Loc PVC pipe below the ground using directionally controlled horizontal drilling equipment and methods. All directional boring methods and equipment shall be approved by the Engineer and the city before any work shall be permitted. All directional boring and pipe installation methods shall be performed in a good workmanlike and safe manner.

Horizontal Directional Drilling (HDD) is a construction method consisting of drilling a small diameter pilot hole within the designed tolerances for radius requirements, followed by enlargement of the hole by back reaming to accommodate the utility pipeline.

503-2.5.1. GENERAL REQUIREMENTS

The overall work scope shall include, but not be limited to steerable directional boring equipment, boring pits and equipment, sheeting, location signs as required, maintenance of traffic and miscellaneous appurtenances to complete the entire Work as shown on the Contract Drawings, and restoration. Directional boring operations shall be performed within the right-of-way and/or easements shown on the Drawings.

The HDD Contractor shall assume full responsibility for his methods of construction, the stability and accuracy of the drilled and reamed hole and pits constructed by him, and all costs for damages resulting from any failure thereof and be solely responsible for the safety of the pits and related structures, and personnel engaged in underground construction throughout the duration of the work.

The general dimensions, arrangement and details for the drilled pilot hole and entry and exit pits to be constructed shall be as indicated on the approved Shop Drawings.

Methods of excavation, equipment and procedures for the HDD operation and pits shall be selected to provide adequate working space and clearances for the work to be performed.

Utility Protection: Utility lines and structures indicated on the Drawings, which are to remain in service, shall be protected from any damage. Where utility lines or structures not shown on the Drawings are encountered, Contractor shall report them to the city and the Engineer before proceeding with the Work.

All utilities within 10 feet of the drill pilot bore, back ream or utility carrier pipe installation will be exposed through a soft-dig "pot-hole" or other opening, in accordance with appropriate utility locate laws and regulations, to ensure, through visual inspection, that the drill, reamer or utility carrier pipe has caused no damage to the utility and maintains adequate clearance. All potholes to locate existing utilities shall be sealed with an excavatable grout to avoid a possible flow path for the HDD drilling mud.

Prior to commencing drilling operations, positively locate and stake all existing utility pipelines, cables, storm sewers, or other underground facilities which are located within 10 feet of the designed drilled path.

All work covered by these Technical Specifications shall be performed in accordance with the applicable local, state and federal codes and laws which pertain to such work and supplemental regulations which are contained in these Technical Specifications.

At all times when construction is not in progress, watertight plugs shall be installed in all pipe ends and openings, either following aboveground pipe fusing and storage before pipe pulling or following underground installation after pipe pull back.

503-2.5.2. SUBMITTALS

The Contractor shall prepare a detailed schedule for the work and submit it to the Engineer and the city for approval. The schedule shall include all major tasks to be performed, including but not limited to the following: pipe delivery; rig mobilization and setup; pipe assembly; pilot hole drilling; reaming; pressure testing the pipe before installation; pipe pulling; pressure testing and pigging/flushing the pipe after installation; disinfection of potable water pipelines; anticipated work hours for each task, daily work hours and dates anticipated for each task.

At least 10 days prior to mobilization of equipment, the Contractor shall submit a detailed installation plan to the city and the Engineer for review and approval. The plan shall also include a detailed Plan and Profile of the bore plotted at a scale no smaller than 1-inch equals 20 feet horizontally and 1-inch equals 4 feet vertically. The Contractor shall include a site plan of the entrance and exit pits, the pipe lay down area and equipment staging. Traffic control plans for entry pit, exit pit, and pipe lay down area if different than what is indicated on the Roadway Traffic Control Plan Drawings.

Submit pipe, fittings, specials, joint restraint systems, adapters and couplings shop drawings including complete dimensions including length, internal diameter, pressure rating and wall thickness; maximum allowable deflection of the pipe; detailing; mechanical connections; and necessary accessories for manufacture, transportation, storage, handling, and installation.

Submit pipe assembly procedures including:

1. Descriptions of procedures means and methods for storing, fabricating, handling, transporting, and protecting pipe segments.
2. Calculations of stresses and longitudinal strains developed in pipe during handling and installation.
3. Description of controls to safeguard that the allowable pulling forces will not be exceeded during the installation.
4. Description of procedures for lifting pipe.
5. Calculations showing allowable lifting configurations so allowable stresses will not be exceeded.
6. Welding procedures for high density polyethylene pipe.

Submit a description of procedures, methods and materials that will be used to repair pipe or pipe joints damaged during installation.

Submit a description of methods and materials that will be used to correct leaks in pipe or pipe joints.

Equipment Submittal: Contractor shall submit manufacturer and specifications of directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project. Submittal shall demonstrate that anticipated pullback forces do not exceed the tensile strength of the HDPE pipe with a minimum factor of safety of 2.0. Include calculations prepared by a Professional Engineer licensed in the State of Florida demonstrating maximum allowable pullback forces for this installation / material combination.

Drilling Plan Submittal: Contractor shall submit a Drilling Plan including: Drilling Operations, Reaming Operations, Estimated Pullback Loads, Drilling Fluids Management, Safety Plan, and a Contingency Plan.

A. Drilling Operations submittal shall include:
    1. The number and size of construction crew, hours to be worked, pilot hole drilling procedure, reaming procedure, method of tracking and controlling the drilling head, method of verifying pipe location for as-built drawing and schedule for completing major activities.

2. Provide a 2-inch x 34-inch layout drawing(s), scale 1-inch = 20 feet, indicating location of the entry, exit pits, and fluid storage pits, location of fused pipe before pulling (shall not block access to private property), location and type of fusion equipment, storage of waste fluid, and fluid recycling plan (if used).
3. Spoil handling, separation and disposal.
4. Provide a detail of the planned bore path and the method of monitoring and controlling the speed, line, grade, and rate of fluids delivery.
5. Include the sequence, size and description of each reamer and the capabilities of each through the type of soils anticipated to be encountered in the project area.
6. The Contractor shall maintain the alignment and minimum radii as detailed on the plan sheets and as specified herein.
7. The drill plan should include a final swabbing of the bore path prior to pipe pullback.
8. Contractor shall not proceed with work until Drilling Plan is approved by the Engineer and the city.

B. Reaming Operations submittal shall include the required bore hole size for pullback of the pipeline. The Reaming Operation Plan shall be submitted for review prior to initiation of construction.

C. Estimated Pullback Loads submittal shall include:
   1. The Contractor shall submit to the Engineer an estimate of the anticipated pullback loads that will be required to install the pipe.
   2. Contractor shall include the calculated buoyant force or buoyant weight of the pipe and proposed method for counterweighting or ballasting the pipe during pullback.
      a. Calculation shall be based on anticipated density of the drilling fluid(s) to be used.
      b. Any counterweight or ballast pipe placed inside the pipe shall be free from any dirt, grease, oil, or other contaminants that may prevent proper disinfection.

D. Drilling Fluids Management submittal shall include:
   1. Submit MSDS sheets for drilling fluid additives proposed, demonstrating they are non-hazardous.
   2. Proposed mix design for each specific geological strata or formation anticipated during drilling of the bore path.
   3. Estimate of drilling fluids and quantities to be utilized during each reaming pass.
   4. Delivery volume and pressure for each reaming pass and the proposed method for monitoring.
   5. Details of the drilling fluid/soil slurry solids separation, recycling or disposal plan that will describe the equipment and capacities for separation and recirculation.
      a. If direct vacuum excavation of the slurry is selected, the disposal site shall be identified, and copies of all required permits shall be presented to the Engineer.
      b. The Contractor shall submit a written plan that details the estimated quantity of slurry to be vacuum excavated and provide substantiation that there is sufficient equipment to adequately pump or shuttle the slurry to and from the disposal site(s) as required to maintain a near continuous drilling and pipe pull-back.
   6. The Contractor shall submit to the Engineer a contingency plan for a quick response team to address inadvertent fluid discharges to the surface (frac-outs). In the event that a drilling fluid fracture, inadvertent returns or loss of returns occurs during pilot hole drilling operations, Contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fractures or returns loss continues, Contractor will cease operations and notify the Engineer and the city.

   The Engineer, the city and the Contractor will discuss additional options and the Work will then proceed accordingly. Repair and clean-up of damages associated with frac-outs will be resolved in a timely fashion as directed by the city at the Contractor's expense.

E. Safety Plan submittal: The Contractor shall be responsible for securing a safe worksite that meets all Federal, State, and Local government codes. A project safety and contingency plan which shall include but shall not be limited to drilling fluid containment and cleanup procedures, equipment and plan for compromised utility installations including electrical and power lines, potable water, reclaimed water, wastewater, storm water and any other subsurface utility.
F. Contingency Plan submittal: Contractor shall submit contingency plans to address procedures to be employed in the event the following may occur:
    1. Obstruction encountered during drilling or reaming.
    2. Broken drill pipe.
    3. Collapsed or buckled carrier pipe or casing pipe.
    4. HDD fails to advance or fails to respond to steering actions.
    5. Alignment deviation is outside allowable limits.
    6. Installation (pull back) forces reach 75% of the max allowable forces.
    7. Ground settlement/heaving exceed allowable limits set by the Engineer and the city.

Project Records and As-Built Drawings submittals shall include the following:

A. Fusion joint data and fusion technician data indicating conformance with this Technical Specification and applicable standards. This will include fusion joint warranty information and recommended project specific fusion parameters, including criteria logged and recorded by data logger.
B. Certified copies of test reports of factory tests for the pipe to be inserted into the bore hole prepared by HDD methods required by the applicable standards and this Technical Special Provision. Report shall include at minimum include following information:
    1. Dimensional Checks
    2. Pipe Burst
    3. Flattening
    4. Extrusion Quality (Acetone Immersion)
C. Project Records: Maintain a complete set of project records. Maintain a daily activity log during Horizontal Directional Drilling operations. Log shall accurately record entire workday. These documents shall include but not be limited to:
    1. Start and finish time of each section of drill pipe for pilot hole drilling and reaming.
    2. For pilot hole drilling, drill bit location at least every 10 ft. along the drill path. Mark the as-built drawings on a daily basis with drilling progress.
    3. General description of ground condition drilled.
    4. Details and perceived reasons for delays greater than one hour other than normal breaks and shift changes.
    5. Details of any unusual conditions or events.

As-built Drawings: Maintain at the construction site a set of field drawings for recording the pilot hole as-built conditions. Plot as-built conditions on the field drawings, including the location in plan and elevation of the pilot hole.

503-2.5.3. QUALITY ASSURANCE AND COORDINATION OF WORK

HDD Contractor's Experience: Any horizontal directional drilling operations 16'' or larger diameter installation shall be conducted by an experienced HDD Contractor. The HDD Contractor shall have minimum of five years of experience constructing horizontal directional drills for pipelines of the same or larger diameter and the same or greater lengths. A responsible representative of the HDD Contractor and the city must be present at all times during a directional drilling operation. A responsible representative as specified herein is defined as a person experienced in the type of Work being performed and who has authority to represent the Contractor in a routine decision making capacity concerning the manner and method of carrying out the Work.

Qualifications and Experience of Contractor Personnel: The Contractor shall employ skilled, experienced superintendent(s), drill rig operators, and key personnel. A competent and experienced superintendent representing the HDD Contractor, that is thoroughly familiar with the equipment and type work to be performed, must always be in direct charge and control of their operation. In all cases the superintendent shall be continually present at the job site during the actual directional drilling.

The superintendent(s) and drill rig operators shall each have at least three years of successful experience using the HDD process, on at least five (5) projects with similar or greater diameters, pull back length and ground conditions. The superintendent(s), drill rig operator, and key personnel shall demonstrate successful completion of at least five (5) projects where pipe was installed with horizontal directional drilling techniques. The Contractor shall furnish resumes of the superintendent(s), drill rig operator(s) and other key personnel. Personnel experience records should include project names, locations, pull back lengths, ground conditions, pipe materials, project description, city project number, Engineer, and references with names, addresses and telephone numbers. The superintendent, drill rig operator(s) and other key personnel listed in the submittal shall be on-site during all construction related activities required for HDD installation.

A responsible representative of the HDD Contractor and the city shall be present at all times during the directional drilling operation. A responsible representative as specified herein is defined as a person experienced in the type of Work being performed and who has authority to represent the Contractor in a routine decision making capacity concerning the manner and method of carrying out the Work.

The HDD Contractor shall always have a sufficient number of competent workers on the job to ensure the directional bore is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual drilling operation must be on the job site from the beginning through the completion of the work.

The Contractor shall use certified HDPE pipe welding and fusion operators. The certifications of these individuals shall be made available prior to construction. HDPE pipe welding and fusion operators shall be certified by the pipe manufacturer prior to commencement of pipe welding and fusing operations.

The equipment used in directional boring, also known as horizontal directional drilling, shall be of adequate commercial size and satisfactory working condition for safe operation, and may be subject to approval by the city or at the discretion of the Engineer. Such approval, however, shall not relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Only workmen experienced in directional boring operations shall be used in performing the Work.

The Contractor shall provide all structures, safety equipment, and professional services required to provide for the health and safety of the general public and of personnel involved in directional boring work in accordance with the requirements of the regulatory agencies having jurisdiction The Contractor shall take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, and appurtenances from damage due to directional boring work. Responsibility and payment for correction of such damage shall be the sole responsibility of the Contractor and at no additional cost to the city.

The HDD operation is to be operated in a manner to eliminate the discharge of water, drilling mud, and cuttings to nearby water bodies or to the land areas involved during the construction process. If inadvertent spills to nearby water bodies occur, the Contractor shall immediately provide environmental controls and cleanup to the satisfaction of, and at no additional expense to the city.

Best Management Practices (BMP's) for erosion control within the Contractor's work area shall be implemented and maintained at all times during drilling and back-reaming operations to prevent siltation and turbid discharges in excess of State Water quality Standards pursuant to Rule 62-302, F.A.C. Methods shall include but are not limited to the immediate placement of turbidity containment devices such as turbidity screen, silt containment fence, hay bales, and earthen berms, etc. to contain the drilling mud.

503-2.5.4. HDD PIPE PRODUCTS

The horizontal directional drilling shall only use Certa-Loc PVC or butt-welded

HDPE pipe which meets the requirements specified in *Section 502*. Refer to *Section 502-2.4*. for the HDPE Butt Fusion Process and installation procedures for HDD installations.

503-2.5.5. GENERAL HDD INSTALLATION CONSIDERATION

The Contractor shall furnish all equipment and materials required, including but not limited to the following:

1. Drilling equipment (Drilling rig, drill head, drill pipe, drilling control system, pipe pull heads, pipe rollers).
2. Water pumps, hoses, fittings, storage tanks, vacuum truck(s), filters, hay bales, and silt fences, as required.
3. Drilling fluids containment, collection, cleaning and disposal equipment, and materials.
4. Fuel and lubricants.
5. Bentonite and related mixing equipment.
6. All hydrostatic testing equipment and materials.
7. Side booms, cranes, backhoes, trucks and other equipment and materials necessary to load and unload pipe, and to support and smoothly transition the pipe while being pulled into the reamed hole.

All equipment used in the horizontal directional drilling operation shall have the built-in capacity, stability and necessary safety features required to fully comply with the Technical Specifications and requirements of this section without showing evidence of undue stress or failure, and shall otherwise be in sound operating condition.

Backup equipment, sufficient spares and replacement items shall be required where job site conditions indicate that severe damage to the roadway or a hazardous condition may result in the event of an equipment breakdown and where the condition of the equipment to be used indicates that routine component replacement or repair will likely be necessary during the drilling operation.

If equipment breakdowns or other unforeseen stoppages occur and forward motion of the directional cutting head is halted at any time other than for reasons planned in advance (addition of drill stems, etc.), the bore hole shall remain filled with Bentonite slurry and the slurry shall be recirculated periodically.

If an existing utility is damaged, pavement cutting for inspection may be approved by the roadway authority (state, county or city) and the city representative after consideration of all pertinent facts indicates that such action would offer the most practical solution to the problem for all parties concerned.

Any such authorized pavement opening shall be repaired according to appropriate regulatory agency's specifications and requirements. No cutting of the pavement will be allowed on interstate or other limited access roadways unless approved by FDOT.

The boring tool shall have a steering capability and have an electronic tool detection system. The position of the tool during operation shall be capable of being determined accurately both horizontally and vertically.

503-2.5.6. HDD DRILLING EQUIPMENT AND DRILLING FLUID

General: The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore(s) and pullback of the pipe(s), a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a drilling guidance system to accurately guide boring operations, a vacuum truck or mud separation plant of sufficient capacity to handle the drilling fluid volume, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working

order for the duration of this project. All required equipment shall be included per the emergency and contingency plan as submitted per these Technical Specifications.

Drilling Rig:

A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull drill pipe while delivering a pressurized fluid mixture to a steerable drill head. The machine shall be anchored to withstand the pulling, pushing and rotating forces required to complete the project.
B. The drilling rig hydraulic system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks.
C. The drilling rig shall have a system to monitor and record maximum pull-back forces during pull-back operations.
D. The drilling rig shall be grounded during drilling and pullback operations. There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

Drill Head:

A. The horizontal directional drilling equipment shall produce a stable fluid filled bore hole with the use of a steerable drill head.
B. The system shall be able to control the depth and direction of the pipe.
C. Drill head shall contain all necessary cutters and fluid jets for the operation and shall be of the appropriate design for the soil or rock being drilled.

Drill Pipe: Drill pipe shall be constructed of high quality 4130 seamless tubing, Grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC. Drill pipe shall be capable of drilling the design drill path and of pulling back the HDPE pipe.

Drilling Fluid System:

A. Drilling Fluid (Mud):
    1. Drilling Fluid shall be a high-quality bentonite drilling fluid or equivalent to ensure hole stabilization, cuttings transport, bit and electronics cooling and hole lubrication to reduce drag on the drill pipe and the product pipe. Oil based drilling fluids or fluids containing additives that can contaminate the soil or ground water shall not be considered acceptable substitutes. Composition of the fluid must comply with all applicable local, state and federal environmental regulations.
    2. Drilling fluid shall be composed of clean potable water and the appropriate additive(s) for the fluid to be used. Water shall be from a clean potable source and shall meet the mixing requirements of the manufacturer. Reclaimed water shall not be considered an acceptable alternative to potable water.
    3. Potable water shall be obtained from a metered city Water Utility construction service connection paid for by the Contractor. The contractor shall follow all city Water Utility Department requirements regarding backflow prevention, service water metering, and cross connection control.
    4. The water and additives shall be mixed thoroughly to assure the absence of any clumps or clods. No hazardous additives may be used.
    5. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall(s).
    6. Drilling fluid shall be disposed of off-site in accordance with local, state and federal requirements and/or permit conditions. Disposal of drilling fluids shall be in compliance with environmental regulations, right-of-way and workspace agreements and permit requirements.

7. No additional chemicals or polymer surfactants shall be allowed to be added to the drilling fluid as submitted for this project without written consent of the city and the Engineer.

B. Drilling Fluid Mixing System:
   1. A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid for the project.
   2. The drilling fluid reservoir tank shall be a minimum of 1,000 gallons.
   3. The mixing system shall be able to ensure thorough mixing of the drilling fluid. The drilling fluid reservoir tank shall be sized for adequate storage of the fluid.
   4. The mixing system shall continually agitate the drilling fluid during drilling operations.

C. Drilling Fluid Delivery and Recovery System:
   1. The mud pumping system shall have a minimum variable capacity of 35 to 500 gpm and the capability of delivering the drilling fluid at a constant minimum pressure of 1200 psi.
   2. The delivery system shall have filters or other appropriate in-line equipment to prevent solids from being pumped into the drill pipe.
   3. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and disposed of in a legal manner at approved solid waste landfills. The use of spill containment measures shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps, vacuum truck(s), and/or storage of sufficient size shall be in place to contain excess drilling fluid.
   4. A closed-loop drilling fluid system and a drilling fluid cleaning system should be used to the extent practical, depending upon project size and conditions. Under no circumstances shall drilling fluid that has escaped containment (i.e. inadvertent returns) be reused in the drilling system.

Pipe Pull Heads:

A. Pipe pull heads shall be utilized that employ a positive through-bolt design assuring a smooth wall against the pipe cross-section at all times.
B. Pipe pull heads shall be specifically designed for use with high density polyethylene (HDPE) pipe or PVC fusible pipe as appropriate and shall be as recommended by the pipe supplier.

Drilling Control System:

A. Calibration of the electronic detection and control system shall be verified prior to the start of the bore.
B. The drilling head shall be remotely steerable by means of an electronic or magnetic detection system. The drilling head location shall be monitored in three dimensions, X, Y and Z:
   1. Distance along the baseline, X.
   2. Offset from the baseline, Y, and.
   3. Depth of bore, Z.
C. The guidance system shall be capable of tracking at all depths up to 50 feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate and calibrated to the manufacturer ‘s specifications of the vertical depth of the borehole at sensing position at depths up to 50 feet and accurate to 2-feet horizontally.
D. Point of rotation of the head shall also be monitored.
   Pipe Rollers:

Pipe rollers shall be used for pipe assembly and during final product pull back.

503-2.5.7. PREPARATION AND MOBILIZATION FOR HDD OPERATIONS

Do not commence directional drilling until all required submittals have been approved by the Engineer and the city.

Do not begin drilling until all pipe and special items for drilling have been delivered.

All drilling operations shall be accomplished during daylight hours and shall not begin after the hour pre-established as the latest starting time that will allow completion during daylight hours. Planned nighttime work will generally not be allowed unless stipulated in the special conditions of the city's Agreement. In emergency situations, or where delay would increase the likelihood of a failure, nighttime work may be allowed to complete the drilling operations.

Mobilize all necessary personnel, equipment, and materials to construct an entry area for drilling operations. Provide appropriate supports to maintain safe working conditions; ensure stability of the entry, exit, settlement, and containment pits; minimize loosening, deterioration and disturbance of the surrounding ground.

The drilling site shall contain the horizontal directional drilling rig, drill pipe storage racks, water and slurry pumps, slurry mixing tank, cuttings separation equipment, primary settlement and containment pits, dry storage area for bentonite, crane or lifting equipment, and site office.

The pipe launcher/roller system (or equal) shall be constructed in the specified area. The pipe lay down area shall be as determined in conjunction with the Engineer and the city and shall be used to facilitate the installation of the pipeline.

503-2.5.8. ENVIRONMENTAL REQUIREMENTS

Provide equipment and procedures to maximize the recirculation of drilling mud and to minimize waste. Provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse.

Inadvertent surface returns or "frac-outs" of drilling fluid that is accessible on land must be cleaned up immediately and the surface area washed and returned to original condition. All drilling fluids, spoils and separated material will be disposed of in compliance of state and local environmental regulations. If the amount of surface returns exceeds that which can be contained and collected using small sumps, drilling operations shall be discontinued until surface return volumes can be brought under control. Equipment and materials for cleanup and contingencies must be provided and stored at all HDD sites.

Construction related activities involving fuels and lubricants such as vehicle refueling and equipment maintenance, including the draining and pumping of lubricants shall be conducted at a minimum distance of 50 feet from surface water bodies, drainage ditches or swales, drainage pathways and storm water collection structures to eliminate contamination in case of a spill. Any fuels, drilling fluids, or lubricants spilled shall be cleaned up immediately and comply with all FDEP requirements.

Contractor shall provide sanitation and garbage facilities on both sides of the HDD operation. Wastes shall be transported offsite for disposal.

Immediately upon completion of work, all rubbish and debris shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean, and acceptable condition approved by the city.

503-2.5.9. DRILLING OPERATIONS

Supply all necessary drilling equipment for completing the HDD installation as shown on the approved Shop Drawings.

The plan and profile for the horizontal directional drilling operation shall be in accordance with the approved Shop Drawings.

Drill entrance and exit angles shall be as shown on the approved Shop Drawings.

Drilling Tolerances: A smoothly curved pilot hole shall follow the designated centerline of the pipe profiles as shown on the Drawings. The directional tolerance of the holes will be as follows:

A. Deviations from, and corrections to, the design centerline of the HDD pipeline construction shall not exceed 2 percent in depth per 100 feet horizontal or a lesser rate determined by the structural characteristics of the selected pipe and jointing system.
B. The as-built variance from the designed bore path shall not exceed plus or minus 1-foot in the vertical plane and plus or minus 2-feet in the horizontal plane.

503-2.5.10. HDD INSTALLATION

General: The Contractor shall install the HDPE pipe by the horizontally drilled, directionally controlled method of construction.

Instrumentation: The Contractor shall always provide and maintain instrumentation which shall accurately locate the pilot hole position in the X, Y and Z axes relative to the ground surface and measure drill string axial and torsional loads. Drilling fluid flow rate and pressure shall also be monitored. The Contractor shall maintain and provide to the city Inspector and the Engineer access to the data generated by the downhole survey tools.

Drilling Guidance and Pullback:

A. Pipe installed by horizontal directional drilling shall be located as shown on the Drawings. The Contractor shall plot the actual horizontal and vertical alignment and the depth of the pilot bore at intervals not exceeding 10 feet. Deviations between the recorded position of the drill string and the specified position of the drill string shall be documented and immediately brought to the attention of the Engineer. This “as-built” plan and profile shall be updated as the pilot bore is advanced. At the completion of the pilot hole, the Contractor shall provide the coordinates of the pilot hole as specified.
B. The Contractor shall provide and use on land, a separate steering system employing a ground survey grid system, equal to “Tru-Tracker”.
C. The Contractor shall have accurate working gauges which register tensile force being used to pull the pipeline back through the reamed borehole. If, during the pipeline pulling process, this force reaches 75 percent of the allowable load for the pipeline, the Engineer shall be notified immediately, and the Contractor shall prepare to initiate the contingency plan provided within the approved Project submittals. Logs shall be kept referencing all forces exerted on the pipeline during the installation.
D. The Contractor shall provide adequate pipe supports/rollers along the stringing area (for both entry and exit pits) to support the required length of pipe for each location. The rollers shall be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback.
E. The pipe entry area shall be graded to provide support for the pipe to allow free movement into the borehole. The pipe shall be guided in the borehole to avoid deformation of, or damage to the pipe. The pipe shall be installed in a manner which will not cause upheaval, settlement, cracking, movement, or distortion of surface features.
F. During pullback operations, the Contractor shall monitor roller operation and use side booms if required to assist movement of the pipe and to avoid damage to the pipe.
G. Cease installation operations if damage to the pipe occurs. Damage to the pipe shall be repaired immediately. Pulling operations shall not resume until the pipe has been repaired.

H. Pipe pullback shall be planned to occur continuously until complete, except for stoppages planned in the course of the operation such as drill rod removal or if damage to the pipe is observed during pullback that needs to be repaired before continuing. Contractor shall implement necessary buoyancy control as stated in the approved HDD Method and Work Plan.

Location Detection Wire for HDD Pipeline Installations: Refer to *Section 502-2.5.2. B.* for specifications regarding material and installation of Location Detection Wires for HDD installations.

503-2.5.11. DRILLING MUD AND CUTTINGS

The horizontal directional drilling operation shall be conducted in a manner to eliminate the discharge of water, drilling mud, and cuttings to areas not involved in the construction process. The Contractor shall immediately contain and clean-up any inadvertent drilling fluid returns. The Contractor shall also provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste disposal.

Disposal of water, drilling fluids, drilling mud, cuttings, and muck shall be the Contractor's responsibility. Disposal of waste materials shall be in a legal manner at approved solid waste landfills.

503-2.5.12. REAMING AND PULLBACK

Reaming: Reaming operations shall be conducted at the discretion of the Contractor. Choosing to simultaneously ream and pull back the pipe is at the discretion and the sole risk of the Contractor. All provisions herein relating to simultaneous reaming and pulling back operations shall also pertain to reaming operations.

A. Prior to pulling pipe, enlarge pilot hole to the diameter identified in the reaming procedure submittal. The Contractor shall ream the borehole to a minimum of 12-inches larger than the outside diameter of the pipe or 1.5 times the outside diameter of the pipe, whichever is less, using the appropriate tools. Complete a swab pass if necessary.
B. Ream at rates consistent with the drilling equipment and mud system selected.
C. Continue to monitor the drilling fluid viscosity and density to reduce the potential for frac-out.

Pulling Loads: The Contractor shall be responsible for determining safe pulling loads required for proper installation. Such loads shall be minimized to prevent failure of the pipeline during installation. Once pullback operations have commenced, operations shall continue without interruption until the pipe is completely pulled into the borehole. During pullback operations, the Contractor shall not apply more than the maximum safe pipe pull pressure at any time. A break away head rated at the maximum safe pull pressure shall be utilized.

Torsional Stress: A properly sized and fully operational swivel shall be installed between the reaming assembly at the end of the drilling pipe and the pipeline to restrict torsional stress from being transmitted to the pipeline.

Ballast: The pipeline must be filled with water (ballasting) as installation proceeds, to prevent buckling and reduce buoyancy.

Pull Section Support: The pipe section shall be supported as it proceeds during pull back so that it moves freely.

503-2.5.13. PIPELINE PROTECTION

Protect the interior of the pipe from entry of foreign matter until the installation is complete and accepted.

Contractor shall video record the inside of the pipe after it has been installed and verify that no cracks, breaches, gouges, holes, etc. have occurred during pullback that would decrease the integrity of the pipe.

503-2.5.14. PIPELINE CLEANING

Following installation of the pipeline installed by HDD, the pipeline shall be hydraulically cleaned and flushed as specified in *Section 504* of these Technical Specifications.

503-2.5.15. PIPELINE TESTING

Pressure Testing: Hydrostatically test pipe before and after installation in accordance with *ASTM F2164-Field Leak Testing of Polyethylene Pressure Piping Using Hydrostatic Pressure* and *Section 505.* of these Technical Specifications.

A. Test Duration: The total test time including initial pressurization, initial expansion, and time at test pressure, must not exceed a total of 8 hours. If the test is not completed due to leakage, equipment failure, etc., the test section shall be depressurized and allowed to "relax" for a minimum of 8 hours before it is brought back up to test pressure. The test procedure consists of initial expansion phase and leakage test phase.
B. Initial Expansion Phase: During the initial expansion phase, the test section is pressured to the test pressure and enough make-up water is added each hour for a total of three hours to return to test pressure.
C. Leakage Test Phase: The leakage test phase immediately follows the initial expansion phase. The test section shall be brought back up to the test pressure and remain at that pressure for 4-hours in duration. At the end of the 4-hour test time period, the test section shall be within +/-2 psig of the test pressure with zero leakage (no water added).
D. Zero Leakage: The portion of the HDD pipeline to be hydrostatically tested with HDPE butt fused joints shall have zero leakage for the entire 4-hour leakage test duration for the HDD pipe section to have passed the leakage test.
   Test Pressure: The test pressure for the HDD pipeline shall be 150 psi for potable water and reclaimed water or 100 psi for wastewater.

The Contractor shall furnish all materials, equipment, and labor required for making pressure and leakage tests. Tests shall be performed in the presence of the Engineer and the city Inspector.

503-2.5.16. DISINFECTION FOR HDD POTABLE WATER PIPELINES

Final disinfection for potable water pipelines installed by HDD, following cleaning, flushing and pipeline testing, shall be in accordance with *Section 506.* of these Technical Specifications.

503-2.5.17. CITY ACCEPTANCE

If the finished installation of the HDD is not satisfactory to the city, the Engineer or other jurisdictional entity, due to any of the following: the pipe alignment being outside of the specified limits of ±1.0 foot of the coordinates for the entry or exit points stated on the Drawings; failure to pass the leakage or pressure tests; or internal damage to the pipeline; the pipeline shall be abandoned, fully pressure grouted in place, in accordance with the jurisdictional authority, and an alternate installation shall be constructed. The abandoned pipeline shall be properly shown on Record Drawings to be submitted following conclusion of the construction work.

If the HDD pipeline construction is to provide an HDPE casing pipe for a carrier utility pipe, casing spacers shall not be permitted inside the HDPE casing pipe.

If the HDD installation is for a casing pipe, the Contractor shall end-seal the annular space between the casing pipe and the carrier pipe using concrete brick and mortar which shall extend at least 8-inches into the casing pipe. To secure the ends of the casing and to preclude the entrance of water and soil into the casing, the casing ends shall be completely sealed to be watertight with a neoprene rubber seal specifically manufactured for that purpose. The neoprene end seal shall be attached to the casing and the carrier pipe

with Type 304 stainless steel bands. The casing end seals shall be constructed to be basically watertight to preclude the intrusion of groundwater into the casing. Casing end seals shall be equal to Cascade Water Works Model CCES or an approved equal listed in the *City of Clearwater Approved Products List*.

The Engineer shall inspect the installed pipe ends for roundness and/or damage. Evidence of significant surface scratching shall be brought to the attention of the Engineer. Gouges or excessive surface damage of more than 10 percent of the wall thickness will be grounds to abandon the bore and have the Contractor re-drill another pipeline at no cost to the city.

The city shall be provided with test logs from the Contractor indicating the actual maximum pull loads, maximum deflection angle encountered during the pulling operation and the actual X, Y and Z coordinates of the pipe centerline at a maximum of every 10 feet horizontally of the HDD pipe for review as part of final acceptance.

Contractor shall review the internal video of the HDD installation and report any deficiencies to the Engineer and the city. A copy of the video shall be provided to the city as part of the Record Documents submittal for the completed and accepted Work.

503-2.5.18. REPAIR

Pipes damaged during handling or installation shall be pushed or pulled out or repaired in-place using replacement sections and butt fusion welds recommended by the pipe manufacturer following methods described in the approved submittal.

503-2.5.19. CLEANUP AND REPAIR

Following the installation, remove all equipment, material, drilling mud and waste from both work area ends of the HDD installation. The project site shall be returned to a condition equal to or better than the pre-construction condition of the site. All excavations will be backfilled and compacted to 98% maximum dry density under roadways and hardscape, or to 95% maximum dry density for all other areas and shall be graded to original contours. Compaction Testing shall be performed in accordance with *Section 201-2.9 – Backfill and Compaction* of these Technical Specifications. All pavement and hardscape shall be repaired per applicable jurisdictional standards, excess materials shall be removed from the site, and disturbed areas shall be re-landscaped. All drilling fluid shall be properly disposed of per these Technical Specifications and all applicable jurisdictional laws.

Areas or facilities disturbed or damaged during construction shall be restored to original or better condition with new materials prior to the completion of construction unless specifically identified on the Drawings to be modified. This includes areas or facilities outside or inside the roadway rights-of-way, previous construction activities being done as part of this Project, and ancillary roadways, retention ponds, landscaping, signage, billboards, utility boxes and equipment, utility poles, and utility lines.

503-3. SETTING OF VALVES, HYDRANTS AND FITTINGS

503-3.1. GENERAL

Valves, hydrants, fittings, plugs and caps shall be set and joined to pipe in the manner specified above for installation of pipe.

503-3.2. Fittings

The weight of ductile iron fittings shall not be carried by the pipe on which they are installed. The fitting shall be supported by a concrete cradle as shown on the standard details. Concrete used for supports shall

have a minimum compressive strength of 3,500 psi at 28 days. Concrete for the support cradle shall be poured against undisturbed soil.

All glands, clamps, bolts, nuts, studs, and other uncoated parts of fitting joints for underground installation shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

503-3.3. VALVES

Valves for potable water mains and reclaimed water mains shall be located within the street rights-of-way lines unless shown otherwise on the plans. All valves shall be installed adjacent to the tee in all cases, not to exceed 18-inches from the main line.

Valves of the size and type shown on the Drawings shall be set plumb and installed at the locations indicated on the Drawings. Valves shall be installed in accordance with the manufacturer's written installation and operation instructions; with the approved shop drawing submittals; and with the details shown on the Drawings.

Buried valves shall be installed such that they are supported properly in their respective positions, free from distortion and strain with a concrete cradle as shown on the Standard Details. Concrete used for supports shall have a minimum compressive strength of 3,500 psi at 28 days. Concrete for the support cradle shall be poured against undisturbed soil. Valves shall be installed such that their weight is not borne by piping or equipment that are not designed to support the weight of the valve. Exposed aboveground valves shall be supported with fabricated piping supports so that the weight of the valve is not carried by the pipeline.

Install gate valves with the operating stem in the vertical position. Valves shall be carefully inspected during installation; they shall be opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign material from becoming lodged in the valve seat. Check and adjust all valves for smooth operation.

Aboveground Valves: For aboveground flanged valves, clean iron flanges by wire brushing before installing the valves. Clean stainless-steel flange bolts and nuts lubricate threads with a fluoropolymer coating to prevent galling and tighten nuts uniformly and progressively. Flanged joints shall be watertight; no leaks shall be allowed.

Buried Valves: For buried valves, a valve box shall be centered accurately over the operating nut and the entire assembly shall be plumb. Extensions or risers for valve boxes shall be an integral part of the box. No cut sections of ductile iron or PVC pipe shall be used to extend the valve box to its proper height. The tops of valve boxes shall be adjusted to the proper elevation as specified below and as shown on the Drawings. Care shall be taken while constructing valve boxes to ensure that valve stems are vertical and the cast iron valve box has been placed centered and plumb over the valve stem nut of the valve with base bearing on compacted fill and the top flush or above final grade, as specified below. Valve boxes shall have sufficient bracing to maintain alignment during backfilling. When installation is complete, no pressure shall be exerted by the valve box on either the valve or the pipe. The Contractor shall remove any sand or undesirable trash or debris from valve box interior prior to final inspection.

A. In paved areas, tops of valve box covers shall be set 1/4-inch below pavement. Following paving operations, a 24-inch square shall be neatly cut in the pavement around the box and the paving removed. The top of the box shall then be adjusted to the proper elevation and a 24-inch square by 6-inch thick concrete pad poured around the box cover. Concrete pads in traffic areas shall be reinforced with No. 4 reinforcement bars as shown on the Drawings. Concrete for the pad shall be 3,500 psi compressive strength at 28 days.
B. In unpaved areas, tops of valve box covers shall be set 2 inches above finished grade. After the top of the box is set to the proper elevation, a 24-inch square by 6-inch thick concrete pad shall be

poured around the box cover. Concrete for the pad shall be 3,500 psi compressive strength at 28 days.

C. The concrete pad for the valve box cover shall have a 3-inch diameter, brass identification disc embedded in the concrete surface as shown on the Drawings. The brass identification disc shall have the information as shown on the Drawings neatly engraved, not stamped, on it.

Refer to City Standard Detail Index No. 402; Sheet 1 of 3 & Sheet 2 of 3 for potable water valve pad detail, and City Standard Detail Index No. 502; Sheet 1 of 3 & Sheet 2 of 3 for reclaimed water valve box and pad detail.

Hydrostatic Testing: Valves shall be tested hydrostatically, concurrently with the pipeline in which they are installed. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the pressure used for the pressure test(s). If valve joints leak during pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and hydrostatically retest the joints.

Coating Repair: Following installation of buried valves, repair any scratches, marks and other types of surface damage, etc., with a coating equal to the original coating supplied by the manufacturer. Prior to backfilling, all nuts, bolts, and other parts of the valve joints shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

503-3.4. FIRE HYDRANTS

Hydrants shall be located as shown or as directed so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.

Each hydrant shall be connected to the potable water main with a 6-inch ductile iron branch tee with flow controlled by an independent 6-inch mechanical joint gate valve for isolation at the branch of the water main tee. If the fire hydrant is placed greater than 20-feet from the main, an additional 6-inch mechanical joint valve shall be installed at the hydrant location and shall be included in the hydrant assembly cost. The fire hydrant valve cannot be located anywhere within the hydrant ductile iron pipe branch line to circumvent the requirement of using two valves. Refer to *City Standard Detail Index 409*, for potable water hydrants.

All fire hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to, the curb, with the pumper nozzle facing the curb. Fire hydrants shall be set to the established grade, with nozzles as shown or as directed by the Engineer.

Hydrostatic Testing: Fire hydrants shall be tested hydrostatically, concurrently with the pipeline in which they are installed. If the hydrant mechanical joints leak during pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and hydrostatically retest the joints.

Coating Repair: Following installation of buried portions of the hydrants, repair any scratches, marks and other types of surface damage, etc., with a coating equal to the original coating supplied by the manufacturer. Prior to backfilling, all buried nuts, bolts, and other parts of the hydrant mechanical joints shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

Reclaimed Water System: No hydrants shall be installed on the reclaimed water system unless approved by the city's Engineering Department.

503-3.5. ANCHORAGE

Movement of all plugs, caps, tees, bends, etc., unless otherwise specified shall be prevented by attaching approved mechanical restraining rings or glands and installed per manufacturer's recommendations.

Hydrants shall be held in place with restrained swivel joints. Restraining mechanical joint glands on hydrants may be used where hydrant run out length precludes the use of hydrant connecting swivel joints.

Where special anchorage is required, such anchorage shall be in accordance with details shown on the plans.

503-4. CONNECTIONS TO EXISTING POTABLE WATER OR RECLAIMED WATER LINES

The Contractor shall coordinate making connection of the new mains to mains which are in service at the time of construction with the city. All potable water or reclaimed water main connections, regardless of new or existing pipe size, to existing potable water or reclaimed water mains shall be made by the Contractor only after the connection procedure and his Work scheduling has been reviewed and approved by the Engineer and the city Engineering Department. The Contractor shall submit a written request to the Engineer and the city Engineering Department a minimum of 5 working days prior to scheduling said connections. The request shall outline the following.

A. Location of points of connection, fittings to be used, and method of flushing and disinfection, if applicable.
B. Estimated construction time for said connections.

The Engineer and the city Engineering Department shall review the Contractor's submittal within 3 working days after receiving it and inform the Contractor regarding approval or denial of his request. If this request is rejected by the city, the Contractor shall resubmit his request modifying it in a manner acceptable to the city.

Connections to existing potable water or reclaimed water mains shall only be made following completion of new potable water or reclaimed water main cleaning operations and successful completion of pressure and leakage testing and disinfection clearance of the new potable water main.

The Contractor shall not connect to existing facilities unless the Engineer and a representative of the city are present. All connections shall only be made on the agreed upon date and time. If the Contractor does not initiate and complete the connection work in the agreed upon manner, the Contractor shall be required to reschedule the said connection by following the procedure outlined above.

Operation of all existing potable water or reclaimed water system valves shall be the responsibility of the city's personnel only. At no time shall the Contractor operate any existing system valves. System valves shall be defined as any valve which has main pressure against either side of the valve. The Contractor shall notify the city to request that a valve be operated, at least 5 days prior to the time operation is required.

Upon satisfactory completion of all hydrostatic testing of the new potable water or reclaimed water pipeline, and disinfection of the new potable water pipeline, remove restrained joint caps from both ends of the new pipeline, close main line isolation valves on the existing main, cut and drain the existing main and swab all pipe and fittings for the connection to be installed on the new main with 10 percent hypochlorite solution. The connection of the new main to the existing main shall be made as swiftly as possible and any water collected in the ditch shall be pumped out and kept below the level of the pipe bottom. Following connection and make-up of all fittings, the new pipeline shall then be placed into service by the city's operating personnel.

In the event any existing customers will be without potable water while a connection is being made, the Contractor shall notify the city's Inspector 72 hours prior to disconnection. The city Utility Department shall notify the affected customer(s) when the water will be turned off and when the service is estimated to be resumed. In some instances, these connections may have to be made at late night or early morning hours. No user shall be without potable water service for more than three hours, unless approved otherwise by the city.

504. PIPELINE CLEANING

Following installation of the potable water or reclaimed water pipelines, the pipelines shall be cleaned using a combination of hydraulic cleaning using poly-pig swabbing devices and full bore flushing as specified below.

504-1. PIPELINE PIGGING

All pipelines shall be hydraulically cleaned utilizing multiple pass operations with a polypropylene swabbing device, also referred to as "pigging" operations, of the piping system. Between successive operations, the pig diameter shall increase, and the pig material shall stiffen. Poly pigs shall be blown elastomer polyurethane with open cell-type construction having a material density suitable for use within the system to be cleaned. Pipe cleaning poly pigs shall have a parabolic nose, crisscross coated with a resilient peripheral surface that engages the inner cylindrical wall of the pipe to maintain a sliding seal. Pipe cleaning poly pigs shall be able to pass through a reduction of a minimum of sixty-five percent (65%) of the original cross-sectional area of the pipe and shall be bi-directional. Cleaning procedures shall conform to the Poly Pig manufacturer's recommendations.

The Contractor shall provide pig launching and retrieval points for the pipeline cleaning, as required. The poly pig cleaning operation shall be completed prior to connection of the new potable water main or reclaimed water main to an existing potable water main or reclaimed water main.

Passage of cleaning poly pigs through the system shall be constantly monitored, controlled, and all poly pigs entered into the system shall be individually marked and identified so that the exiting of the poly pigs from the system can be confirmed.

Cleaning of the pipeline system shall be done in conjunction with the initial filling of the system for the hydrostatic testing.

The line to be cleaned shall only be connected to an existing potable water or reclaimed water distribution system at a single connection point. Only the city's operating personnel shall operate the supply valve from the existing potable water or reclaimed water distribution system.

The Contractor shall locate and open all new in-line valves beyond the point of connection on the pipeline to be cleaned during the swabbing operation.

At the receiving or exit point for the poly pig, the Contractor is responsible for creating a safe environment for collection of debris, water, and the swab. The Contractor shall provide for the protection of surrounding personnel and property and the safe retrieval of the poly pig.

Temporary blowoffs may be required for the purpose of flushing mains. Temporary blowoffs shall be installed as close as possible to the ends of the main being flushed. Blowoffs installed on the main shall be the same diameter as the main. Temporary blowoffs shall be removed and plugged after the main is flushed.

The city Utility Department shall be notified at least 72 hours prior to pigging and flushing mains.

Cleaning and flushing shall be accomplished by propelling the poly pig down the pipeline to the exit point with potable or reclaimed water, depending on the type of main being cleaned. Flushing shall continue until the water is completely clear and poly pig is retrieved.

A. Re-apply a series of individual poly pigs in varying diameters and/or densities as required, to attain proper cleanliness of pipeline.
B. Pigging speed shall range between two and five feet per second.

504-2. FINAL PIPELINE FLUSHING

Following the pigging process for cleaning the pipeline, the length of new water main shall be final flushed with a full-bore clean water flush with a flushing velocity of at least 2.5 fps. The time required for the final full bore flush shall be based on the time needed at the required flushing velocity to provide one complete turnover of the quantity of water in the pipeline based on the length and diameter of water main being flushed.

Blowoffs and temporary drainage piping used for flushing shall not be discharged into any gravity sewer or pumping station wet well. The Contractor shall obtain prior approvals from the Engineer and the city as to the methods and locations of flushing water discharge.

At the discretion of the city, full bore water flushing may not be required for a particular water main based on the size of the main being cleaned and the quantity of water usage required for a full bore water flush.

Following the pigging and flushing process, pressure testing of the pipeline shall be completed in accordance with *Section 505* below.

505. TESTS

505-1. HYDROSTATIC PIPELINE TESTING

General: The Contractor shall perform hydrostatic pressure and leakage tests on all newly laid pressure pipes, fittings and valves for potable water mains and reclaimed water mains. After installation of the water mains, complete with all associated appurtenances including service taps, all sections of newly laid water main shall be subject to a hydrostatic pressure test as described below.

Standard: AWWA C600, Section 4, with the exceptions required herein. The Contractor shall furnish all closure pieces in the pipe as required. All equipment required for the hydrostatic pressure test shall be furnished by the Contractor and shall include, but not be limited to, graduated containers, pressure gauges, meters, testing taps and valves, hydraulic pressure pumps, suitable hoses and piping and any other equipment needed to hydrostatically test the pipelines. Hydrostatic tests shall be conducted on all newly laid potable water main or reclaimed water main pipes, fittings, and valves including any branch lines to the curb. Tests shall be made between valves not exceeding 2,000 feet.

The Contractor may conduct a preliminary hydrostatic test after the trench has been partially backfilled with the joints left exposed for an initial leakage test for his inspection and informational purposes only. The hydrostatic testing for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified.

Test new pipelines which are to be connected to existing pipelines by isolating the new line from the existing line by means of pipe caps, special flanges, or blind flanges. After the new line has been successfully tested, remove temporary caps or blind flanges and connect to the existing piping.

The Engineer and the city's Inspector shall be present during all inspection, pressure, and leakage testing for the results to be considered acceptable for the city's acceptance of the new potable water main or reclaimed water main system. Successful passage of both the pressure test and the leakage test is required before acceptance by the city.

The hydrostatic pressure and leakage testing described herein is intended for non-butt-welded jointed pipe with gasketed joints.

Where any section of the piping contains concrete thrust collars, do not proceed with the pressure test until at least 10 days after the concrete has been poured. If high-early cement is used for the concrete thrust collars, the time may be reduced to three (3) days, if the Engineer and the city Engineering Department

both concur that the concrete has cured and reached adequate strength. When testing cement mortar-lined piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.

Each section of pipe to be tested shall be slowly filled with water and the specified test pressure shall be applied by means of a pressure pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe as described below. If defective pipes, fittings or valves are discovered in consequence of this pressure test, all such items shall be removed and replaced by the Contractor with sound new material, the pipe shall be re-cleaned and the pressure test shall be repeated until satisfactory results are obtained. Provisions of AWWA C-600, where applicable, shall apply.

Hydrostatic Pressure Test:

A. Test Pressure: Potable Water Mains - 150 psi; Reclaimed Water Mains – 150 psi; Wastewater Force Mains – 150 psi. Apply and maintain the test pressure by means of a hydraulic pressure pump. The test pressure shall be maintained ±2 psig throughout the entire test period.
B. Test Duration: 2-hours. If during the test, the integrity of the tested line is in question, the Engineer or the city's Inspector may require an additional pressure test.
C. Air Release Requirements: Tapping saddles and corporation cocks at least 3/4-inch in diameter, pipe riser and angle globe valves shall be installed by the Contractor at each dead-end and at all high points in the main to bleed all air from the water main to be tested.
D. Zero leakage and no pressure loss shall be allowed for the pressure pipe being tested.

Visible Leakage: All visible leaks evident at the ground surface shall be repaired and leakage eliminated.

Leakage Repair: Repairs to leaks shall be completed in strict accordance with the pipe manufacturer's written recommendations. Repair and retest any pipes showing leakage.

Damage or Defects: Any exposed pipe, fittings, valves, hydrants, and joints shall be examined during the test. Any damage or defects that are discovered shall be replaced with new material at no additional cost to the city. The test shall be repeated until no damage or defects are discovered.

505-2. NOTICE OF TEST

The Contractor shall give the city's Project Manager and/or Representative forty-eight (48) hours advance notice of the time when the installation is ready for hydrostatic testing.

City inspector/CEI shall certify and submit all hydrostatic pressure and leakage testing results to the city Project Manager within 10 days of performing test(s).

506. DISINFECTION AND TESTING

Before the new potable water system is put into operation, all new potable water mains and appurtenances and any item of new construction with which the water comes into contact, shall be thoroughly disinfected in accordance with AWWA C651. This section includes materials and procedures for disinfection of water mains by the continuous feed method.

506-1. DISINFECTION MATERIALS

Dry Calcium Hypochlorite: High test granular calcium hypochlorite (HTH) used as the chlorinating agent shall contain between 65 to 70 percent of available chlorine by weight. The dry calcium hypochlorite shall be stored in a cool, dry, and dark environment, prior to its use, to minimize deterioration.

Sodium Hypochlorite Solution: Sodium hypochlorite solution used as the chlorinating agent shall be obtained fresh and shall have a minimum concentration of 10 percent by weight available chlorine. To

minimize degradation, sodium hypochlorite solution shall be stored in opaque, closed polypropylene containers, isolated from contact with any metals and out of direct sunlight. The solution shall be stored in covered (as dark as possible) areas and as cool as possible, prior to use on the jobsite. Sodium hypochlorite solution is highly corrosive. Therefore, the Contractor shall use this chlorinating agent with caution and per the recommendations of the sodium hypochlorite solution manufacturer.

Chlorine Residual Test Kit: To measure chlorine concentration, provide and use a mid-range total chlorine test kit with a digital titrator, using sodium thiosulfate as the titrant. Maintain fresh reagents for the test kit and maintain all components of the kit in good working order available for immediate testing of chlorine residuals at the point of sampling.

506-2. FLUSHING SYSTEM

Prior to pressure testing and application of the disinfection agent for disinfection, all pipelines shall be hydraulically cleaned utilizing multiple pass operations with a polypropylene swabbing device, also referred to as "pigging" operations, of the piping system, followed by full bore flushing. Flushing shall continue until a clean, clear stream of water flows from the hydrants. Where hydrants are not available for flushing, such flushing shall be accomplished at the installed blow off devices generally at the ends of the lines. Cleaning and flushing prior to pressure testing and disinfection shall be in accordance with *Section 504* of these Technical Specifications.

506-3. FINAL DISINFECTION PROCEDURE FOR POTABLE WATER MAINS

Before any portion of a new potable water piping system is to be placed into service, it shall be disinfected; and proper disinfection shall be demonstrated by bacteriological testing conducted in accordance with "Standard Methods for Examination of Water and Sewage" for the coli-aerogenes group, by a commercial laboratory approved by the FDEP, and acceptable to the Engineer and the city, or may be completed by the Pinellas County Health Department.

All pipe, fittings, valves, and all other appurtenances installed for use in potable water pipelines shall be disinfected prior to being placed in service. Disinfection procedures shall be approved by the Engineer and the city and shall be in conformance with ANSI/AWWA C651, latest revision. Contractor shall comply with all General Notes on the Drawings and special requirements that are included with the FDEP permit related to disinfection and clearance of new potable water mains.

Pipe subjected to contaminating materials shall be treated in a manner approved by the Engineer and the city. Should such treatment fail to remove contaminants from the pipe, contaminated sections of pipe shall be replaced with new uncontaminated pipe.

Only potable water from an existing city water main shall be used for disinfection and final flushing of new potable water pipelines. The potable water shall be obtained as described below in *Section 508* of these Technical Specifications.

Disinfection Procedure: Disinfection of a completed potable water pipeline shall be accomplished using the following procedure:

A. All water piping, fittings, valves, and appurtenances shall be disinfected with a chlorine solution with a sufficient concentration such that the initial chlorine concentration in the water line shall be a minimum of 75 mg/l available chlorine, at any point in the line, and that a chlorine residual of not less than 30 mg/l remains in the water, at any point in the line, after standing 24 hours in the pipeline. The contact period may be longer than 24-hours, if required by the city or the Engineer

before it is flushed out. All valves in the lines being disinfection shall be opened and closed several times during the contact period.

B. Chlorine may be applied to the water pipeline as a liquid 10% sodium hypochlorite solution, or as a mixture of water and high-test calcium hypochlorite. The Contractor shall assume responsibility for safe handling of chlorinating agents and shall meet requirements of OSHA and other regulatory agencies for safe handling of chlorinating agents.
C. The dry high-test calcium hypochlorite (HTH) may be used to make up a high concentration chlorine solution which will be used for disinfection. The hypochlorite solution to be used for disinfection should be mixed based on the HTH manufacturer's recommendations. Under no circumstances will undiluted, dry calcium hypochlorite be placed in the pipeline to be disinfected.
D. The chlorine solution, either 10% sodium hypochlorite or a calcium hypochlorite mixed solution, shall be metered into the pipeline with a small metering pump.
E. Disinfection of Valves, Blind Flanges and Appurtenances: Swab exposed interior surfaces of valves and blind flanges with a 10% sodium hypochlorite solution prior to installation and bolting in place.
F. Disinfection of Tapping Sleeves, Tapping Valves and Line Stops: Flush exterior of pipe with potable water after removal of existing coating. Swab exterior of pipe and interior of tapping, sleeve, tapping valve and line stop valve with a 10% sodium hypochlorite solution. Disinfect per AWWA C651, Section 4.8. After completion of tapping and line stopping, swab interior of pipe, valves, and faces of flanges to be connected to bypass piping with a 10% sodium hypochlorite solution.
G. Disinfection of Connections to Existing Pipelines: Disinfect isolation valves, pipe, and appurtenances per AWWA C651, Section 4.7. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 10% sodium hypochlorite solution. Following disinfection procedures, flush with potable water again until water is free of chlorine odor.
H. Water from the existing, in-service water line shall be made to flow at a constant, slow rate into the water line to be disinfected. A jumper connection from the existing potable water main to the new water main, utilizing a reduced pressure principle backflow preventer approved by the city, shall be used to obtain water for disinfection. Chlorine solution shall be injected or pumped at a regulated rate into the new main, at a point not more than 10 feet downstream from the beginning of the new water main. The method of tapping the water main for the chlorine injection point and the location of the tap shall be approved by the Engineer and the city.
I. Proportion the two rates so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 75 mg/L. Check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added.
J. Chlorine solution shall be circulated in the water main by opening the water control valve and systematically manipulating valves, fire hydrants and blowoffs.
K. Water service lines, if applicable, shall be disinfected in a similar manner as that for water mains, including corrective measures, by methods acceptable to the Engineer and the city.
L. Chlorine solution shall remain in the water lines for not less than 24-hours, but longer than 24-hours, if directed by the Engineer or the city.
M. Extreme care shall be exercised at all times to prevent concentrated chlorine solution from entering existing water mains.

If methods of disinfection used by the Contractor differ materially from those outlined above, such methods shall be in accordance with directives of the Florida State Board of Health and all methods employed shall have the approval of that agency.

506-4. FLUSHING AND RESIDUAL CHLORINE TESTS

After 24-hours, or when approved by the Engineer and the city, the free residual chlorine concentration in the water line at the pipe extremity sample points shall be checked to make sure the free residual chlorine concentration is at least 30 mg/l; if not, the water lines shall be re-disinfected as described above.

Final flushing of lines with potable water may proceed after 24 hours, or when approved by the Engineer and the city, provided the free residual chlorine analysis is satisfactory at 30 mg/L or above. Flushing shall be continued until a chlorine residual test shows that the pipelines contain only the normal chlorine residual in the feed potable water, not less than 0.2 ppm nor more than 3.0 ppm. Residual chlorine test shall be in accordance with standard methods using a standard DPD test kit. Prior to flushing water with high chlorine concentrations, obtain approvals from the Engineer and the Owner as to the methods and locations of discharge.

City inspector/CEI must certify and submit all residual chlorine test results to the city Project Manager within 10 days of performing test(s).

506-5. BACTERIALOGICAL TESTS

Following disinfection and thorough flushing of the water lines, as specified herein, the Contractor, and/or the city Public Utilities Department Water Division (or the Engineering Department), shall furnish all labor and materials required to obtain samples of water from the potable water line, at established remote sampling points approved by the FDEP, properly collected in suitable sterilized containers obtained from the Pinellas County Health Department or an analytical laboratory approved by the city and certified by the Florida State Board of Health for bacterial examination in accordance with AWWA C651. Proper techniques and procedures shall be used to collect the water samples to avoid outside contamination resulting in a false positive coliform result. Definite instructions as to the collection and shipment of bacteriological samples shall be secured from the laboratory prior to sample collection and shall be followed in all respects.

Two (2) series of successive samples shall be obtained at each established sampling point in accordance with AWWA C651, Section 5.1, to obtain a bacteriological quality test result to demonstrate the absence of coliform bacteria in each separate section of the pipeline being tested after chlorination, flushing and refilling. Each test series will require two samples at each sampling point. The period between each series of samples shall be a minimum of 24-hours. Samples shall be delivered by the Contractor to the County Health Department or the approved analytical laboratory for bacteriological examination within 6 hours of obtaining the samples. Samples shall be collected in conformance with the County Health Department standards and lab testing schedule. Prior to collecting samples, the Contractor shall notify the Engineer and the city, who will have representatives present during bacteriological sample collection.

Collect at least one set of samples from every 1,000 feet of the new water main and line stopping insertion point, plus one set from the end of the line and at least one set from each branch. At each connection to an existing pipeline, take two additional samples.

Bacteriological test results will be available approximately 48- to 72-hours after samples have been submitted to the testing laboratory. If test results are unsatisfactory, the Contractor shall immediately re-chlorinate and retest the water lines as described above and proceed with such corrective measures as are necessary to secure disinfected lines. All services shall be re-chlorinated if the lines are re-chlorinated. The water lines shall be re-disinfected and re-tested, at the Contractor's expense, until approved by the Engineer, the city, and the Pinellas County Health Department or FDEP, as applicable.

At satisfactory completion of the bacteriological test requirements, potable water pipelines shall be placed into service in a manner approved by the Engineer and the city Engineering Department. Complete the pipeline where temporary disinfection or test facilities were installed. Potable water mains shall not be

placed into service until all requirements of the State and Pinellas County Public Health Departments are met, and the Letter of Clearance is obtained from the Florida Department of Environmental Protection (FDEP). The Contractor shall notify the Engineer and the city at least 72 hours prior to placing potable water pipelines into service.

The city Inspector/CEI shall certify and submit all bacteriological test results to the city Project Manager within 10 days of performing the test(s) as required by the Florida Department of Environmental Protection.

507. CORRECTION OF NON-CONFORMING WORK

All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the city. Non-conforming work shall be defined as failure to adhere to any specific or implied directive of this Project Manual and/or the drawings, including but not limited to paid not laid straight, true to the lines and grades as shown on the drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, visible or detectable leakage and failure to pass any specified test or inspection.

508. OBTAINING WATER FOR FLUSHING AND TESTING

The potable water supply shall be protected with an air gap or a reduced pressure principle backflow preventer approved by the city if potable water is used for flushing and testing. Only potable water shall be use for flushing and pressure testing of potable water pipelines. Reclaimed water may be used for flushing and pressure testing of reclaimed water lines or wastewater force mains.

The city will provide the water required for city Projects. The Contractor shall coordinate with the city for a temporary construction water service connection, intended for usage during flushing and testing.

For private development projects the Contractor will need to obtain temporary potable water service during construction, the Contractor shall be required to pay for the installation and for the water used. The piping, fittings, backflow preventer, and appurtenances required for the temporary construction water service shall be supplied by the city of Clearwater.

509. MEASUREMENT AND PAYMENT

509-1. GENERAL

Bids must include all sections and items as specified herein and as listed on the Bid Form. Payment for the work of constructing the project will be made at the unit price or lump sum payment for the items of work as set forth in the Bid, which payment will constitute full compensation for all labor, equipment, and materials required to complete the work. No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work unless otherwise specified:

- Clearing and grubbing
- Excavation, including necessary pavement removal
- Shoring and/or dewatering
- Structural fill
- Backfill
- Grading
- Tracer wire
- Refill materials
- Joint materials

- Tests and sterilization
- Appurtenant work as required for a complete and operable system.

509-2. FURNISH AND INSTALL WATER MAINS

509-2.1. MEASUREMENT

The quantity for payment shall be the actual number of feet of pipe of each size and type satisfactorily furnished and laid, as measured along the centerline of the completed pipeline, including the length of valves and fittings.

509-2.2. PAYMENT

Payment of the applicable unit price shall be full compensation for furnishing all plant, labor, materials and equipment, and constructing the water mains completely and ready for operation.

509-3. FURNISH AND INSTALL FITTINGS

509-3.1. MEASUREMENT

The quantity for payment will be the actual number of size and type of ductile iron fittings satisfactorily furnished and installed.

509-3.2. PAYMENT

Payment of the applicable unit price shall be full compensation for furnishing all plant, labor, materials, and equipment required to furnish and install ductile iron fittings.

509-4. FURNISH AND INSTALL GATE VALVES COMPLETE WITH BOXES AND COVERS

509-4.1. MEASUREMENT

The quantity for payment shall be the number of gate valves of each size satisfactorily furnished and installed.

509-4.2. PAYMENT

Payment of the applicable unit price for each size shall be full compensation for furnishing all labor, materials, and equipment and installing the gate valve complete with valve box and cover, concrete pad and valve disc, including any jointing materials and any restraint devices required.

509-5. FURNISH AND INSTALL FIRE HYDRANTS

509-5.1. MEASUREMENT

The quantity for payment shall be the number of fire hydrants satisfactorily furnished and installed. The only hydrants allowed to be installed in the city utilities system are listed in *Section 502-5* of these Technical Specifications. No exceptions.

509-5.2. PAYMENT

Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the fire hydrant assembly complete including all necessary anchor tees, swivel-type thrust anchorage, 6-inch ductile iron pipe between the main and the fire hydrant and gate valve(s) and valve boxes and covers, concrete pad(s) and valve disc(s) on the hydrant branch line and , including any jointing materials and any restraint devices required.

600 SERIES: STORMWATER

601. RAISING OR LOWERING OF STORM DRAINAGE STRUCTURES

Storm Drainage Structures shall be raised or lowered as indicated on the plans or as indicated by the Engineer.

601-1. BASIS OF PAYMENT

Payment, unless covered by a bid item, shall be included in the cost of the work.

602. UNDERDRAINS

The Contractor shall construct sub-surface drainage pipe as directed in the Scope of Work and detail drawings contained in the Project construction plans. In general, underdrain pipe shall be embedded in a bed of #6 FDOT aggregate, located behind the back of curb and aggregate surface covered with a non-degradable fibrous type filter material. A #57 aggregate may be used in lieu of #6 if it is washed and screened to remove fines. The aggregate may be stone, slag, or crushed gravel. Unless otherwise noted on the plans, underdrain pipe shall be eight inches (8") in diameter, polyvinyl chloride pipe, in conformance with ASTM F758 "Standard Specification For Smooth Wall PVC Underdrain Systems for Highways" latest revision, minimum stiffness of 46 in conformance with ASTM D2412, perforations in conformance with AASHTO M-189 described in *FDOT Section 948-1.5* or latest revision and in conformance with ASTM D3034 - SDR 35.

Alternate acceptable underdrain pipe material is Contech A-2000 which is a rigid PVC pipe that exceeds ASTM Specifications D1784, minimum cell classification of 12454B or 12454C, manufactured per ASTM F949-93a, minimum pipe stiffness of 50 psi, with no evidence of splitting, cracking or breaking when pipe is tested in accordance with ASTM D2412 at 60% flatting and with a double gasket joint.

Underdrain pipe placed beneath existing driveways and roadways shall be non-perforated pipe with compacted backfill. All poly-chloride pipe which has become deteriorated due to exposure to ultraviolet radiation shall be rejected. Where ductile iron pipe is specified, pipe material shall be the same as specified for potable water pipe in these technical specifications. All underdrain aggregate shall be fully encased in a polyester filter fabric "sock" (Mirafi® 140-N or approved equal) per the construction detail drawings.

Filter aggregate for underdrains shall be as specified in the *FDOT Standard Specifications, Section 901 – Coarse Aggregate*, and shall be either #6 or #57. If #57 is used, it must be washed and screened to remove fines. The aggregate may be stone, slag, or crushed gravel.

602-1. BASIS OF MEASUREMENT

Measurement shall be the number of linear feet of eight inch (8") Sub-drain in place and accepted.

602-2. BASIS OF PAYMENT

Payment shall be based upon the unit price per linear foot for underdrain as measured above, which shall be full compensation for all work described in this section of the specifications and shall include all materials, equipment, and labor necessary to construct the underdrain (specifically underdrain pipe,

aggregate and filter fabric). Underdrain clean-outs, sod, driveway, road and sidewalk restoration shall be paid by a separate bid item.

603. STORM SEWERS

All storm drainpipe installed within the city shall be steel reinforced concrete unless otherwise approved by the City Engineer. Said pipe shall comply with *Section 430 of FDOT Standard Specifications.*

All reinforced concrete pipe joints shall be wrapped with Mirafi® 140N filter fabric or equivalent (as approved by the City Engineer). The cost for all pipe joint wraps shall be included in the unit price for the pipe.

All pipe, just before being lowered into a trench, is to be inspected and cleaned. If any difficulty is found in fitting the pieces together, this fitting is to be done on the surface of the street before laying the pipe, and the tops plainly marked in the order in which they are to be laid. No pipe is to be trimmed or chipped to fit. Each piece of pipe is to be solidly and evenly bedded, and not simply wedged up. Before finishing each joint, some suitable device is to be used to find that the inverts coincide, and pipe is clear throughout.

603-1. TESTING AND INSPECTION

The Contractor shall take all precautions to secure a watertight sewer under all conditions.

The work under this Section shall include the internal video recording of new stormwater drainage pipes and drainage structures. The Contractor shall provide the city with a video of the completed stormwater drainage system, and a written report. The Contractor shall pump down and clean the pipes and drainage structures, to the satisfaction of the city, prior to video recording. The video shall be of the standard DVD format, in color, with all the pertinent data and observations recorded as audio on the DVD. The data should include:

1. An accurate recorded footage of the pipe lengths.
2. The drainage structure number and pipe size.
3. The run of the pipe and direction of flow (i.e. from S-1 to S-2).
4. Details of structural defects, broken pipes, sags, dips, misalignments, obstructions, and infiltration.

The written report shall include the four (4) items listed previously.

All visual and video recording inspections shall be completed by the Contractor and be in accordance with *Section 430-4.8 of FDOT Standard Specifications*. Any deficient or damaged pipe discovered during the video recording process shall be the responsibility of the Contractor to repair or replace at their own expense within the contractual duration.

As a complement to the video report, the Contractor shall also provide digital photos of areas of concern in electronic (computer CD/DVD) and hard copy form (in color).

All known pipe breaks or those breaks discovered after the video inspection shall be repaired by the Contractor regardless of the test allowances. Faulty sections of drainage pipes or drainage structures rejected by the Engineer shall be removed and re-laid by the Contractor. Sections of pipe that are repaired, re-laid or replaced shall be accompanied with a corresponding post construction video inspection at the Contractor's expense. In all cases that a leak is found, re-inspection shall be required at the Contractor's expense, to confirm that the problem has been resolved.

603-2. BASIS OF PAYMENT

Payment shall be the unit price per linear foot for storm sewer pipe in place and accepted, measured along the centerline of the storm sewer pipe to the inside face of exterior walls of storm manholes or drainage

structures and to the outside face of endwalls. Said unit price includes all work required to install the pipe (i.e. all materials, equipment, filter fabric wrap, gravel bedding if needed for stabilization, labor, and incidentals, etc.).

604. STORM MANHOLES, INLETS, CATCH BASINS OR OTHER STORM STRUCTURES

For details on specific design of a type of storm structure refer to city of *Clearwater Standards Details Index Numbers 201 to 236*.

When required, inlets, catch basins or other structures shall be constructed according to the plans and applicable parts of these Technical Specifications, *Sections 301, 302, 303 and 202*, and as approved by the Engineer. Said structures shall be protected from damage by the elements or other causes until acceptance of the work.

604-1. BUILT UP TYPE STRUCTURES

Built up type manholes shall be constructed of brick with cast iron frames and covers as shown on city of *Clearwater Standard Details Index Numbers 201*. Invert channels shall be constructed smooth and semicircular in shape conforming to inside of adjacent sewer section. Changes in direction of flow shall be made in a smooth curve of as large a radius as possible. Changes in size and grade of channels shall be made gradually and evenly. Invert channels shall be built up with grout.

The storm structure floor outside of channels shall be made smooth and sloped toward channels.

Manhole steps shall not be provided. Joints shall be completely filled, and the mortar shall be smoothed from inside of the manholes.

The entire exterior of brick manholes shall be plastered with a skim coat of one-half inch (1/2”) of mortar.

Brick shall be laid radially with every sixth course being a stretcher course.

In cases where a storm pipe extends inside a structure, the excess pipe will be cut off with a concrete saw and shall not be removed with a sledgehammer.

604-2. PRECAST TYPE

Precast manholes shall be constructed as shown on city *of Clearwater Standards Details Index 202*. The manhole base shall be set on a pad of dry native sand approximately five inches (5”) thick to secure proper seating and bearing.

Precast Manholes and Junction Boxes: The Contractor may substitute precast manholes and junction boxes in lieu of cast in place units unless otherwise shown on the plans. Precast Inlets will not be acceptable. When precast units are substituted, the construction of such units must be in accordance with ASTM C478, or the standard specifications at the manufacturer’s option.

Precast structures must also meet the requirement that on the lateral faces, either inside or outside, the distance between precast openings for pipe or precast opening and top edge of precast structure be no less than wall thickness. A minimum of four courses of brick will be provided under manhole ring so that future adjustment of manhole lid can be accommodated. Manhole steps shall not be provided.

604-3. BASIS OF PAYMENT

Payment for Junction Boxes, Manholes or other structures shall be on a unit basis.

605. GABIONS AND MATTRESSES

605-1. MATERIAL

605-1.1. PVC COATED WIRE MESH GABIONS & MATTRESSES

605-1.1.1. GABION & MATTRESS BASKETS

Gabion and mattress baskets units shall conform to ASTM A975, be of non-raveling construction and fabricated from a double twist by twisting each pair of wires through three half turns developing the appearance of a triple twist. The galvanized wire core shall have a diameter of 0.106 inches.

605-1.1.2. PVC (POLYVINYL CHLORIDE) COATING

The coating shall be gray in color and shall have a nominal thickness of 0.0216 inches but not less than 0.015 inches in thickness. The protective PVC plastic shall be suitable to resist deleterious effects from exposure to light, immersion in salt or polluted water and shall not show any material difference in its initial compound properties. The PVC compound is also resistant to attack from acids and resistant to abrasion.

The PVC coating shall be extruded and adhere to the wire core prior to weaving. The PVC coated wire shall be woven into a double twisted hexagonal mesh having uniform openings of 3 1/4 inches by 4 ½ inches. The overall diameter of the mesh wire (galvanized wire core plus PVC coating) shall be 0.146 inches. Selvedge and reinforcing wire shall be of heavily galvanized wire core, 0.134 inches in diameter, coated with PVC and having an overall diameter (galvanized wire core plus PVC coating) of 0.174 inches. Lacing and connecting wire shall be of soft tensile strength (75,000 PSI max), heavily galvanized wire core, 0.087 inches in diameter, coated with PVC and having an overall diameter (galvanized wire core plus PVC coating) of 0.127 inches. The use of alternate wire fasteners shall be permitted in lieu of tie wire providing the alternate fastener produces a four (4) wire selvedge joint with a strength of 1200 lbs. per linear foot while remaining in a locked and closed condition. Properly formed interlocking fasteners shall be spaced from 4 to 6 inches and have a minimum 3/4 square inch inside area to properly confine the required selvedge wires.

605-1.1.3. GABION AND MATTRESS FILLER MATERIAL

The filler stone shall be from a source approved by the Engineer before delivery is started. Representative preliminary samples of the stone shall be submitted by the contractor or supplier for examination and testing by the Engineer. The stone shall have a minimum specific gravity of 2.3 and be of a quality and durability sufficient to insure permanency in the structure. The individual stones shall be free of cracks, seams, and other defects that would tend to promote deterioration from natural causes, or which might reduce the stones to sizes that could not be retained in the gabion or mattress baskets.

All filler material shall be uniformly graded between 4 inch and 8 inch (equivalent spherical diameter) and shall be angular in form. Rounded stones shall not exceed 10% of the stone, by weight and 70% of the stone, by weight, shall exceed the largest dimension of the mesh opening. Crushed concrete shall not be used for filler material.

605-1.1.4. GEOTEXTILE FABRIC

Fabric shall conform to the latest edition of *FDOT Standard Specifications, Section 985*.

605-2. PERFORMANCE

Gabions and Reno Mattresses shall be installed according to the manufacturer's recommendations and as shown on the Drawings. Fabrication of gabion baskets shall be in such a manner that the sides, ends, lid and diaphragms can be assembled at the construction site into rectangular baskets of the sizes specified and shown on the Drawings. Gabions and mattresses shall be of single unit construction; the base, lid ends and sides shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that the strength and flexibility at the connecting point is at least equal to that of the mesh. Where the length of the gabion and mattress exceeds one and one-half its horizontal width, they shall be equally divided by diaphragms of the same mesh and gauge as the mattresses shall be furnished with the necessary diaphragms secured in proper position on the base so that no additional tying is required at this juncture. The wire mesh is to be fabricated so that it will not ravel. This is defined as the ability to resist pulling apart at any of the twists or connections forming the mesh when a single wire strand in a section of mesh is cut.

Each gabion or mattress shall be assembled by tying all untied edges with binding wire. The binding wire shall be tightly looped around every other mesh opening along seams so that single and double loops are alternated.

A line of empty gabions shall be placed into position according to the contract drawings and binding wire shall be used to securely tie each unit to the adjoining one along the vertical reinforced edges and the top selvedges. The base of the empty gabions placed on top of a filled line of gabions shall be tightly wire to the latter at front and back.

To achieve better alignment and finish in retaining walls, gabion stretching is recommended.

Connecting wires shall be inserted during the filling operation in the following manner: Gabions shall be filled to one third full and one connecting wire in each direction shall be tightly tied to opposite faces of each cell at one third height. The gabion shall then be filled to two thirds full and one connecting wire in each direction shall be tightly tied to opposite face of each cell at one two third height. The cell shall then be filled to the top.

Filler stone shall not be dropped more than twelve inches (12") into the gabions and mattresses.

Geotextile fabric shall be installed at locations shown in the Drawings. The surface to receive the cloth shall be prepared to a relatively smooth condition free of obstructions which may tear or cut the cloth. The panel shall be overlapped a minimum of 30 inches and secured against movement. Cloth damaged or displaced during installation, gabion work, or backfill shall be replaced or repaired to the satisfaction of the Engineer at the contractor's expense. The work shall be scheduled so that the fabric is not exposed to ultraviolet light more than the manufacturer's recommendations or five days, whichever is less.

In wet conditions, a base shall be established by spreading and compacting #57 stone prior to placement of geotextile fabric and gabions or mattresses.

700 SERIES: STREETS AND SIDEWALKS

701. RESTORATION OR REPLACEMENT OF DRIVEWAYS, CURBS, SIDEWALKS AND STREET PAVEMENT

Driveways, sidewalks, and curbs destroyed or damaged during construction shall be replaced with the same type of material that was destroyed or damaged, or to existing city Standards, whichever provides the stronger repair. All street pavement destroyed or damaged shall be replaced with the same type of material, to existing city Standards, unless the existing base is unsuitable as determined by the Engineer, then the base shall be replaced with city approved material. All replaced base shall be at least eight inches (8") compacted thickness, or same compacted thickness as the base destroyed plus two inches (2") and compacted to 98% of maximum density per AASHTO T-180. Refer to *Standard Detail Index 104*.

Unless called for in the proposal as separate bid items, cost of the above work including labor, materials and equipment required shall be included in the bid price per linear foot of main or square yard of base.

The bid price for street pavement, restoration or replacement when called for in the proposals, shall include all materials, labor and equipment required to complete the work, and shall be paid for on a square yard basis. When replacement is over a trench for utilities, the area of replacement shall be limited to twice the depth of the cut plus twice the inside diameter of the pipe. All necessary restoration exceeding this footprint will be at the Contractor's expense.

The bid price for restoration or placement of driveways, curbs and sidewalks, when called for in the proposals, shall include all materials, labor and equipment required to complete the work and shall be paid for on the basis of the following units: Driveways, plant mix - per square yard: concrete - per square foot; curbs - per linear foot; sidewalk four inches (4") or six inches (6") thick - per square foot. Concrete walks at drives shall be a minimum of six inches (6") thick and be reinforced with 6/6 X 10/10 welded wire mesh. The Contractor shall notify the Construction Inspector a minimum of twenty-four (24) hours in advance of all driveway, curb, sidewalk and street restoration and replacement work.

702. ROADWAY BASE AND SUBGRADE

702-1. BASE

This specification describes the construction of roadway base and subgrade. The Contractor shall refer to *Section IV, Section 101 "Scope of Work"* of the city's Contract Specifications for additional roadway base and subgrade items.

Roadway base shall be eight inches (8") compacted minimum thickness unless otherwise noted on the plans or directed by the Engineer. The subgrade shall be twelve inches (12") compacted minimum thickness with a minimum Limerock Bearing Ratio (LBR) of 40 unless otherwise noted on the plans or directed by the Engineer. The Contractor shall obtain from an independent testing laboratory a Proctor and an LBR for each type material. The Contractor shall also have an independent testing laboratory perform all required density testing. Where unsuitable material is found within the limits of the base, *Section IV, Section 204 - Unsuitable Material Removal* of the city's Technical Specifications will apply.

Once the roadway base is completed, it shall be primed that same day (unless otherwise directed by the Engineer) per *Section 300 of FDOT's Standard Specifications*. Repairs required to the base that result from a failure to place the prime in a timely manner shall be done to the city's satisfaction, and at the Contractor's expense. No paving of the exposed base can commence until the city approves the repaired base. The cost for placement of prime material shall be included in the bid item for base.

The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of all base and subgrade placement or reworking.

The following base materials are acceptable:

1. **Shell Base:** Shell base shall be constructed in accordance with the latest edition of *Sections 200 and 913 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. The shell shall be FDOT approved. The cost of the prime coat shall be included in the bid item price for base.
2. **Limerock Base:** Limerock base shall be constructed in accordance with *Sections 200 and 911 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. The limerock shall be from a FDOT approved certified pit. The cost of the prime coat shall be included in the bid item price for base. When used, Contractor is required to submit documentation certifying the materials were obtained from a FDOT certified pit.
3. **Crushed Concrete Base:** Crushed concrete base shall be constructed in accordance with the latest edition of *Sections 204 and 901 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. The crushed concrete material shall be FDOT approved. The Contractor shall provide certified laboratory tests on gradation to confirm that the crushed concrete base material conforms to the above specifications. The LBR shall be a minimum of 100. LBR and gradation tests shall be provided to the city by the Contractor once a week for continuous operations, or every 1000 tons of material, unless requested more frequently by the City Engineer or designee. The cost of the prime coat shall be included in the bid item price for base.
4. **Superpave Asphalt Base:** Full depth asphalt base shall be constructed in accordance with the latest edition of *Section 234 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. The cost for preparation, placement, and compaction shall be included in the per ton unit cost for asphalt unless otherwise noted in the project scope and plans. The cost of the tack coat shall be included in the bid item price for asphalt or base.
5. **Reclaimed Asphalt Pavement Base:** Reclaimed asphalt pavement (RAP) base shall be constructed in accordance with the latest edition of *Section 283 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. As per *FDOT Section 283*, RAP material shall be used as a base course only on non-limited access paved shoulders, shared use paths, or other non-traffic bearing applications. The cost for preparation, placement, and compaction shall be included in the per ton unit cost for asphalt unless otherwise noted in the project scope and plans. The cost of the tack coat shall be included in the bid item price for asphalt or base.

702-1.1. BASIS OF MEASUREMENT FOR BASE AND REWORKED BASE

The basis of measurement shall be the number of cubic yards of base in place and accepted as called for on the plans. The maximum allowable deficiency shall be a half-inch (1/2"). Areas deficient in thickness shall either be fixed by the Contractor to within acceptable tolerance, or if so, approved in writing by the City Engineer, may be left in place. No payment, however, will be made for such deficient areas that are left in place.

702-1.2. BASIS OF PAYMENT FOR BASE AND REWORKED BASE

The unit price for base shall include: all materials, roadbed preparation, placement, spreading, compaction, finishing, prime, base, subgrade (unless the plans specify a separate pay item), stabilization, mixing, testing, equipment, tools, hauling, labor, and all incidentals necessary to complete the work. Payment for asphalt base shall be included in the per ton unit cost for asphalt unless otherwise noted in the project scope and plans.

702-2. SUBGRADE

All subgrade shall be stabilized and constructed in accordance with the latest edition of *Sections 160 and 914 of FDOT's Standard Specifications* unless otherwise noted herein. All subgrade shall have a minimum compacted thickness of 12" unless otherwise shown on the plans or directed by the Engineer. If limerock is used, it shall also meet the requirements of *Section 911 of FDOT's Standard Specifications*. Where unsuitable material is found within the limits of the subgrade, *Section IV, Section 204 - Unsuitable Material Removal* of the city's Contract Specifications will apply. The extent of said removal shall be determined by the Engineer in accordance with accepted construction practices. The Contractor is responsible for clearing, grading, filling, and removing any trees or vegetation in the roadbed below the subgrade to prepare it per the plans. The cost of this work shall be included in the unit price for base or subgrade. The Contractor shall obtain from an independent testing laboratory the bearing value of the subgrade after the materials are mixed for the stabilized subgrade and provide the results to the Engineer.

702-2.1. BASIS OF MEASUREMENT

The basis of measurement shall be the number of cubic yards of stabilized subgrade in place and accepted as called for on the plans. The maximum allowable deficiency for mixing depth shall be per the latest edition of *Section 161-6.4 of FDOT's Standard Specifications*. Acceptable bearing values shall be per the latest edition of *Section 160-7.2 of FDOT's Standard Specifications*. Areas deficient in thickness or bearing values shall either be corrected by the Contractor to within acceptable tolerance, or if so, approved in writing by the City Engineer, may be left in place. No payment, however, will be made for such deficient areas that are left in place.

702-2.2. BASIS OF PAYMENT

The unit price for subgrade shall include roadbed preparation, placement, spreading, compaction, finishing, testing, stabilizing, mixing, materials, hauling, labor, equipment and all incidentals necessary to complete the work. If no pay item is given, subgrade shall be included in the bid item for base.

703. ASPHALTIC CONCRETE MATERIALS

This specification is for the preparation and application of all asphaltic concrete materials on roadway surfaces unless otherwise noted.

703-1. ASPHALTIC CONCRETE

703-1.1. AGGREGATE

All aggregates shall be obtained from an approved FDOT source and shall conform to the latest edition of *Sections 901 through 915 of FDOT's Standard Specifications*.

703-1.2. BITUMINOUS MATERIALS

All bituminous materials shall conform to the latest edition of *Section 916 of FDOT's Standard Specifications*.

703-2. HOT BITUMINOUS MIXTURES – PLANT, METHODS, EQUIPMENT & QUALITY ASSURANCE

The plant and methods of operation used to prepare all asphaltic concrete and bituminous materials shall conform to the requirements of *Section 320 of FDOT's Standard Specifications*. Unless otherwise noted, all acceptance procedures and quality control/assurance procedures shall conform to the requirements of *Section 330 of FDOT's Standard Specifications*.

The city shall have the right to have an independent testing laboratory select, test, and analyze, at the expense of the city, test specimens of any or all materials to be used. The results of such tests and analyses shall be considered, along with the tests or analyses made by the Contractor, to determine compliance with the applicable specifications for the materials so tested or analyzed. The Contractor hereby understands and accepts that wherever any portion of the work is discovered, as a result of such independent testing or investigation by the city, which fails to meet the requirements of the Contract documents, all costs of such independent inspection and investigation as well as all costs of removal, correction, reconstruction, or repair of any such work shall be borne solely by the Contractor.

Payment reductions for asphalt related items shall be determined by the following:

1. Density per FDOT's Standard Specifications.
2. Final surface or friction course tolerances per FDOT's Standard Specifications.
3. Thickness will be determined from core borings. Deficiencies of ¼" or greater shall be corrected by the Contractor, without compensation, by either replacing the full thickness for a length extending at least twenty-five feet (25') from each end of the deficient area, or when the Engineer allows for an overlay per FDOT's Standard Specifications. In addition, for excesses of one-quarter inch (¼") or greater, the Engineer will determine if the excess area shall be removed and replaced at no compensation, or if the pavement in question can remain with payment to be made based on the thickness specified in the contract.

The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of the placement of all asphalt.

703-3. ASPHALT MIX DESIGNS AND TYPES

All asphalt mix designs, acceptance procedures and quality control/assurance procedures shall conform to the requirements of the latest edition of *Sections 330 and 334 of FDOT Standard Specifications*. All asphalt mix designs shall be approved by the Engineer prior to the commencement of the paving operation. Reclaimed asphalt pavement (RAP) material may be substituted for aggregate in the asphaltic concrete mixes up to 25% by weight.

703-4. ASPHALT PAVEMENT DESIGNS AND LAYER THICKNESS

All asphalt pavement designs shall conform to the following FDOT requirements:

- Type SP/Spec 334-1
- Type FC/Spec 337-8
- Type B/Spec 234-8
- ATPB/287-8

703-5. GENERAL CONSTRUCTION REQUIREMENTS

The general construction requirements for all hot bituminous pavements (including limitations of operations, preparation of mixture, preparation of surface, placement and compaction of mixture, surface

requirements, correction of unacceptable pavement, Quality Control Testing, etc.) shall be in accordance with *Section 330 of FDOT's Standard Specifications*(latest edition).

703-6. CRACKS AND POTHOLE PREPARATION

703-6.1. CRACKS

Cracks in roadway pavement shall be repaired prior to the application of asphaltic concrete by the following steps:

1. All debris to be removed from cracks by compressed air or other suitable method.
2. Apply a multiple layered application of bituminous binder and fine aggregate, as appropriate to the depth of the crack until the void of the crack is completely filled to the level of the surrounding roadway surface.
3. If application of asphaltic concrete is not to begin immediately after crack repair, cracks are to be sanded to prevent vehicular tracking.
4. Payment for crack filling shall be included in the unit price for asphaltic concrete.

703-6.2. POTHOLES

Potholes shall be repaired prior to the application of asphaltic concrete by the following steps:

1. All debris is to be removed from potholes by hand, sweeping, or other suitable method.
2. A tack coat is to be applied to the interior surface of the pothole.
3. The pothole is to be completely filled with asphaltic concrete, and thoroughly compacted.
4. Payment for pothole preparation shall be included in the unit price for asphaltic concrete.

703-7. ADJUSTMENT OF MANHOLES AND APPURTANENCES

The necessary adjustments of sanitary sewer and storm drain manholes and appurtenances shall be accomplished by the Contractor. The Contractor shall be paid on a per unit basis for each item. Refer to *Section 401-2* of these Technical Specifications for additional information.

The use of manhole adjustment risers is acceptable under the following conditions:

1. The riser shall meet or exceed all FDOT material, weld, and construction requirements.
2. The riser shall consist of an A-36 hot rolled steel meeting or exceeding the minimum requirements of ASTM A36.
3. The riser shall be a single piece with a stainless-steel adjustment stud and shall have a rust resistant finish.
4. The use of cast iron or fiberglass risers is not permitted.

In addition, the installation of each riser shall be per manufacturer's specifications. Each manhole shall be individually measured, and each riser shall be physically marked to ensure that the proper riser is used. Also, the ring section shall be cleaned, and a bead of chemically resistant epoxy applied to the original casting, prior to installation of the riser. It is the Contractor's responsibility to ensure that the manholes are measured, the risers are physically marked, the ring sections are thoroughly cleaned, and that the epoxy is properly applied prior to installation of each riser.

If risers are not used, the adjustment of manholes shall be accomplished by the removal of pavement around manhole, grade adjustment of ring and cover, and acceptable replacement and compaction of roadway materials prior to paving. A full depth backfills using asphalt is acceptable. The use of Portland cement for backfill is not acceptable.

All manhole and valve box adjustments shall be accomplished prior to the application of final asphaltic concrete surface. Unless otherwise noted in the specs or on the plans, the paving operation shall occur within seven (7) calendar days from the completion of the adjustment. On arterial roadways, the manholes are to be ramped with asphalt during the time period between initial adjustment and final resurfacing. Water and gas valves, sewer cleanouts, valve boxes, tree aeration vents, etc., will be adjusted by the Contractor with the cost for this work to be included in the unit cost of the asphalt. Care must be taken around said appurtenances to ensure that they are not paved over. It is the Contractor's responsibility to inform the owners of all utilities of impending work and coordinate their adjustments, so they are completed prior to the scheduled paving.

703-8. ADDITIONAL ASPHALT REQUIREMENTS

1. All impacted radius returns within project limits shall be paved unless otherwise directed by the Construction Inspector or Engineer, with payment to be included in the per ton bid item for asphalt.
2. All pavement markings impacted by placement of asphalt shall be replaced prior to the road being open to traffic unless otherwise noted in the contract scope and plans.
3. All project related debris shall be hauled off the job site by the Contractor in a timely manner and at their own expense in conformance with all regulatory requirements.
4. The Contractor shall pay particular attention to sweeping when paving. Prior to paving, all construction areas shall be swept with a Municipal type sweeper (either vacuum or mechanical type) that picks up and hauls off, dust and dirt. The sweeper must be equipped with its own water supply for pre-wetting to minimize dust. Moreover, the Contractor shall sweep debris off from sidewalks, driveways, curbs and roadways each day before leaving the job site.
5. The application of tack and prime coats (either required or placed at the Engineer's discretion) shall be placed per *Section 300 of FDOT's Standard Specifications*. Tack shall also be applied to the face of all curbs and driveways. The cost (including heating, hauling, and applying) shall be included in the per ton bid item for asphalt, unless otherwise noted in the project scope and plans.
6. Leveling course and spot patching shall be applied to sections of the road as noted on the plans, or as directed by the Engineer, per *Section 330 of FDOT's Standard Specifications*. The cost shall be included in the per ton unit cost for asphalt, unless otherwise noted in the project scope and plans.
7. If an asphalt rubber binder is required, it shall conform to the requirements of *Section 336 of FDOT's Standard Specifications*.
8. On all streets with curb and gutter, the final compacted asphalt shall be one-quarter inch (¼") above the lip or face of said curb per *City Standard Detail Index 101*.

703-9. BASIS OF MEASUREMENT

Basis of measurement will be the number of tons of asphaltic concrete completed, in place and accepted. Truck scale weights will be required for all asphaltic concrete used. The scales must be calibrated and certified by an independent party and carry a state certification.

703-10. BASIS OF PAYMENT

Payment shall be made at the contract unit price for asphaltic concrete surface as specified and measured above. This price shall include all materials, preparation, hauling, placement, tack and/or prime coat either required or placed at Engineer's discretion, leveling, spot patching, filling of cracks, pothole repair, sweeping, debris removal, labor, equipment, tools, and incidentals necessary to complete the asphalt work in accordance with the plans and specifications.

704. ADJUSTMENT TO THE UNIT BID PRICE FOR ASPHALT

When this Section applies to the contract, the unit bid price for asphalt will be adjusted in accordance with the following provisions:

1. Price adjustment for asphalt shall only be made when the current FDOT Asphalt Price Index varies more than ten percent (10%) from the bid price at the time of the bid opening.
2. The Bituminous Material Payment Adjustment Index published monthly by the FDOT shall be used for the adjustment of unit prices. This report is available on FDOT's internet site. The address is: https://www.fdot.gov/construction/fuel-bit/fuel-bit.shtm For additional information, call FDOT at (850) 414-4252.
3. The FDOT Payment Adjustment Index in effect at the time of the bid opening will be used for the initial determination of the asphalt price.
4. The FDOT Payment Adjustment Index in effect at the time of placement of the asphalt will be used for payment calculation.
5. The monthly billing period for contract payment will be the same as the monthly period for the FDOT Payment Adjustment Index.
6. No adjustment in bid prices will be made for either tack coat or prime coat.
7. No price adjustment reflecting any further increases in the cost of asphalt will be made for any month after the expiration of the allowable contract time.
8. The city reserves the right to make adjustments for decreases in the cost of asphalt.

705. ASPHALT DRIVEWAYS

New driveways or existing asphalt driveways that must be altered for project construction shall be constructed or replaced in accordance with the specifications for paving the street with the exception that the base shall be six inches (6"). Remove only enough to allow adequate grade for access to the street. Use Section 703 Asphaltic Concrete, of these Technical Specifications, as specified for the street paving.

When the finished surface of the existing drive is gravel, replacement shall be of like material. Payment shall be the same as Asphalt Driveways.

705-1. BASIS OF MEASUREMENT

Measurement shall be the number of square yards of Asphalt Driveways in place and accepted.

705-2. BASIS OF PAYMENT

Payment shall be the unit price per square yard for Asphalt Driveways as measured above, which price shall be full compensation for all work described in this section of the specifications and shall include all materials, equipment, tools, labor and incidentals necessary to complete the work.

706. CONCRETE CURBS

Concrete Curbs shall be constructed to the line, grade and dimensions as shown on the plans. Unless otherwise noted, all concrete curbs shall have fiber mesh reinforcement and have a minimum strength of 3000 psi at 28 days. Expansion joints shall be placed at intervals not to exceed a hundred feet (100') and scored joints shall be placed at intervals not to exceed ten feet (10'). In addition, all the requirements of these city Technical Specifications Sections 301, 302 and 303 shall also apply. The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of the placement of all concrete curbs.

The finished surface must have a reasonably uniform texture, must be within 1/4 inch of a true profile grade, and must have no deviation in excess of 1/4 inch from a straight edge applied to the pavement perpendicular to the centerline. Areas varying from a true surface in excess of the above stated tolerance may be accepted without correction if the Engineer determines that they were caused by preexisting conditions which could not reasonably have been corrected by the milling operations. Any unsuitable texture or profile, as determined by the Engineer, must be corrected by the Contractor at no additional expense to the city.

706-1. BASIS OF MEASUREMENT

The basis of measurement shall be linear feet of curb in place and accepted.

706-2. BASIS OF PAYMENT

Payment shall be the unit price per linear foot of curb, which price shall be full compensation for all work described in this and other applicable parts of the specifications and shall include all materials, equipment, tools, labor and incidentals necessary to complete the work.

707. CONCRETE SIDEWALKS AND DRIVEWAYS

707-1. CONCRETE SIDEWALKS

Concrete sidewalks shall be constructed to the line, grade and dimensions as shown on the plans or herein specified. Unless otherwise noted, all concrete sidewalks shall have fiber mesh reinforcement and have a minimum strength of 3000 psi at 28 days. Unless otherwise specified, all concrete sidewalks shall have a minimum width of four feet (4'). Concrete sidewalks shall have a minimum thickness of four inches (4"), except at driveway crossings where a minimum thickness of six inches (6") is required. Also, 6/6 X 10/10 welded wire mesh reinforcement is required for all sidewalk that crosses driveways. The welded wire mesh shall be positioned in the middle to upper third of the placement. No compensation shall be given if the welded wire mesh is not properly placed. Expansion joints shall be placed at intervals of not more than 100 hundred feet and scoring marks shall be made every five feet (5'). Concrete shall be poured only on compacted subgrade prepared in accordance with Section 702 of these Technical Specifications. In addition, all the requirements of Sections 301, 302 and 303 of these Technical Specifications shall also apply.

707-2. CONCRETE DRIVEWAYS

Concrete driveways, whether new construction or replacement, shall be a minimum of six inches (6'') in thickness with 6/6 x 10/10 welded wire mesh reinforcement and a minimum horizontal distance between expansion joints of no less than four feet (4') measured in any direction. The welded wire mesh shall be positioned in the middle to upper third of the placement. No compensation shall be given if the welded wire mesh is not properly placed. Concrete shall be poured only on compacted subgrade prepared in accordance with *Section 702* of these Technical Specifications. In addition, all the requirements of *Sections 301, 302 and 303* of these Technical Specifications shall also apply.

The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of the placement of all concrete sidewalks and driveways.

707-3. CONCRETE CURB RAMPS

The contractor is responsible for constructing ADA compliant concrete curb ramps per the plans and installing detectable warning surfaces on said ramps as called for in the plan set. Concrete curb ramps and detectable warning surfaces are to be constructed per FDOT Standards and Specifications.

707-4. BASIS OF MEASUREMENT

The basis of measurement shall be the number of square feet of four inch (4") concrete sidewalk, six inch (6") concrete sidewalk, and six inch (6") concrete driveways in place and accepted.

707-5. BASIS OF PAYMENT

Payment shall be the unit price per square foot for each item as measured above, which shall be full compensation for all work described in this section and other applicable parts of the specifications and shall include all materials, equipment, tools, welded wire mesh where required, labor and incidentals necessary to complete the work.

708. MILLING OPERATIONS

708-1. EQUIPMENT, CONSTRUCTION & MILLED SURFACE

Unless otherwise noted in the specs, plans or this Section, the milling operation shall be performed in accordance with *Section 327 of FDOT's Standard Specifications*. The Contractor shall notify the city Project Manager a minimum of twenty-four (24) hours in advance of all milling.

708-2. ADDITIONAL MILLING REQUIREMENTS

The following are the additional milling requirements:

A. If the milling machine is equipped with preheating devices, the Contractor is responsible to secure any necessary permits, and for complying with all local, state and federal environmental regulations governing operation of this type of equipment.
B. All milled surfaces must be repaved within seven (7) days from the time it was milled, unless otherwise noted in the contract documents.
C. Prior to paving, all milled areas shall be swept with a Municipal type sweeper either of the vacuum or the mechanical type that picks up and hauls off, dust and dirt. The sweeper must be equipped with its own water supply for pre-wetting to minimize dust. Moreover, the Contractor shall sweep debris off of sidewalks, driveways and curbs in addition to the roadways before leaving the job site.
D. In cases where concrete valley swales are present, the adjoining pavement shall be milled to allow for the new asphalt grade to be flush with the concrete surface.
E. The Contractor shall be responsible for removing any asphalt that remains in the curb line and/or median curbs after the milling operation of a street is complete. The cost of this removal shall be included in the bid item for milling.
F. All radius returns on streets to be milled shall also be milled unless otherwise directed by the Engineer, with payment to be included in the bid item for milling.
G. Any leveling or base replacement required after milling shall be applied to sections of the road as noted on the plans, or directed by the Engineer, per *Section 330 of FDOT's Standard Specifications* The cost shall be included in the per ton unit cost for asphalt, unless otherwise noted in the project scope and plans.

H. Any roadway base material exposed as a result of the milling operation shall be primed that same day (unless otherwise directed by the Engineer) per *Section 300 of FDOT's Standard Specifications*. Repairs required to said base that result from a failure to place the prime in a timely manner shall be done to the city's satisfaction, and at the Contractor's expense. No paving of the exposed base can commence until the city approves the repaired base. The cost of said prime shall be included in the bid item for milling.
I. Prior to the placement of asphalt, the face of all curbs and driveways shall be tacked after the milling operation is complete.

708-3. SALVAGEABLE MATERIALS

Unless otherwise specified, all salvageable materials resulting from milling operations shall remain the property of the city. The transporting and stockpiling of salvageable materials shall be performed by the Contractor. The Contractor shall contact the city Project Manager to schedule delivery of material at least 48 hours prior to starting work.

708-4. DISPOSABLE MATERIALS

All surplus materials not claimed by the city shall become the responsibility of the Contractor. The Contractor shall dispose of the material in a timely manner and in accordance with all regulatory requirements in areas provided by the Contractor at no additional expense to the city.

708-5. ADJUSTMENT AND LOCATION OF UNDERGROUND UTILITIES

All private utilities and related structures requiring adjustment shall be located and adjusted by their owners at the owner's expense. city-owned utilities and structures shall be located by the Owner/City and adjusted by the contractor. The Contractor shall arrange their schedule to allow utility owners the time required for such adjustments (minimum 48 hours' notice per State Statute). All utility adjustments shall be completed prior to the commencement of milling and resurfacing operations.

708-6. ADJUSTMENT OF UTILITY MANHOLES

The necessary adjustments of sanitary sewer and stormwater utility manholes and appurtenances shall be accomplished by the Contractor in accordance with *Section IV, Sections 703-7* of the city's Technical Specifications.

708-7. TYPES OF MILLING

There are two types of milling used by the city:

A. **Wedge** – This will consist of milling a six foot (6') wide strip along the curb line of the pavement adjacent to the curb so the new asphalt will align with the original curb height and pavement cross section.
B. **Full Width** – This will consist of milling the entire roadway (i.e. curb line/edge of pavement to curb line/edge of pavement). All existing horizontal and vertical geometry shall remain unless otherwise indicated or approved by the Engineer.

708-8. MILLING OF INTERSECTIONS

Intersections, as well as other areas (including radius returns) are to be milled and repaved to restore and/or improve the original drainage characteristics. Said work should extend approximately fifty (50) feet from the low point of the existing swale.

708-9. BASIS OF MEASUREMENT

The quantity to be paid for will be the area milled, in square yards, completed and accepted.

708-10. BASIS OF PAYMENT

The unit price for milling shall include: all materials, preparation, hauling, transporting and stockpiling of salvageable materials, disposal of all surplus material, any required milling of radius returns and intersections, prime and/or tack coat either required or placed at Engineer's discretion, removal of asphalt from curbs, sweeping, labor, equipment, and all incidentals necessary to complete the milling in accordance with the plans and specifications.

800 SERIES: TRAFFIC SIGNALS, SIGNS AND MARKINGS

801. TRAFFIC SIGNAL EQUIPMENT AND MATERIALS

All traffic signal work shall be performed per *FDOT's Standard Specifications Sections 603 through 699*, unless otherwise specified in the contract documents and plans.

This specification includes, but is not limited to, the following items: all necessary equipment, materials, guaranties, acceptance procedures, signal timings, field tests, grounding, conduit, signal and interconnect cable, span wire assemblies, pull and junction boxes, electrical power service assemblies, poles, signal assemblies, pedestrian assemblies, inductive loop detectors, pedestrian detectors, traffic controller assemblies, controller cabinets and accessories, removal of existing traffic signal equipment, and internally illuminated signs.

All traffic signal installations shall be mast arms and conform to the requirements of FDOT's Mast Arm Assembly standard and shall be signed and sealed by a professional engineer registered in the State of Florida. All mast arm calculations, as well as the geotechnical report, shall also be signed and sealed by a professional engineer registered in the State of Florida. All mast arm colors shall be determined and approved by the city's Traffic Engineering Division prior to ordering from the manufacturer.

All traffic signal indicators for vehicles and pedestrians shall be LEDs and, approved by both the city's Traffic Engineering Division and FDOT. In addition to this, all pedestrian signal indicators shall utilize countdown features.

Contractor changes to the operation of an existing signal is prohibited unless directed by the city's Traffic Engineering Division.

All damaged inductive loop detectors shall be restored by the contractor per *FDOT Index 17781*.

801-1. BASIS OF MEASUREMENT AND PAYMENT

The basis of measurement and payment shall be specified in the contract documents and/or plans and shall include all equipment, preparation, materials, testing and incidentals required to complete the work per the plans.

802. SIGNING AND MARKING

All signing and marking work shall be performed per most current FDOT's Standard Specifications, unless otherwise specified in the contract documents and plans. This specification includes the following work: RPM's (*Section 706*), painted traffic stripes and markings (*Section 710*), thermoplastic stripes and markings (*Section 711*) and tubular delineators/flex posts (*Sections 705 and 972*).

The Contractor is responsible to ensure that striping is correctly placed. Errors in striping or markings shall be "blacked-out" with paint, unless otherwise directed by the Engineer. No payment will be made for these incorrect or "blacked-out" areas. Omissions in striping or markings shall be corrected to the city's satisfaction prior to any payment being made.

The Contractor is responsible for restoring all striping in paint and reflective beading per the FDOT indices mentioned above. The city's Traffic Engineering department shall follow up with thermoplastic striping at a later date unless otherwise specified.

802-1. BASIS OF MEASUREMENT AND PAYMENT

The basis of measurement and payment shall be specified in the contract documents and/or plans and shall include all equipment, preparation, materials, and incidentals required to complete the work per the plans.

803. ROADWAY LIGHTING

All roadway lighting shall be constructed per most current *Sections 715 and 992 of FDOT's Standard Specifications*, unless otherwise specified in the contract documents and plans.

803-1. BASIS OF MEASUREMENT AND PAYMENT

The basis of measurement and payment shall be specified in the contract documents and/or plans and shall include all equipment, materials, testing, and incidentals required to complete the work per the plans.

900 SERIES: LANDSCAPING/RESTORATION

901. WORK IN EASEMENTS OR PARKWAYS

Restoration is an important phase of construction, particularly to residents affected by the construction progress.

The Contractor will be expected to complete restoration activities within a reasonable time following primary construction activity. Failure by the Contractor to accomplish restoration within a reasonable time shall be justification for a temporary stop on primary construction activity or a delay in approval of partial payment requests.

Reasonable care shall be taken for existing shrubbery. Contractor shall replace all shrubbery removed or disturbed during construction. No separate payment shall be made for this work.

The Contractor shall make provision and be responsible for the supply of all water, if needed, on any and all phases of the contract work. The Contractor shall not obtain water from local residents or businesses except as the Contractor shall obtain written permission.

902. GENERAL PLANTING SPECIFICATIONS

902-1. IRRIGATION

902-1.1. DESCRIPTION

A. The work specified in this Section consists of the installation of an automatic underground irrigation system as shown or noted in the plans. Provide all labor, materials, equipment, services and facilities required to perform all work in connection with the underground sprinkler irrigation system as indicated on the drawings and/or specifications. Work noted as "NIC", "existing", or "by others" is not included in this pay item.
B. The irrigation plans are schematic in nature. Valves and pipes shall be located in the turf/landscape areas except at road/paving crossings. All piping under paving shall be sleeved. Changes in the irrigation system layout shall be modified with the approval of the Engineer.

902-1.1.1. QUALITY ASSURANCE

A. The irrigation work shall be installed by qualified personnel or a qualified irrigation subcontracting company that has experience in irrigation systems of similar size, scope, mainline, system pressure, controls, etc.
B. All applicable ANSI, ASTM, FEDSPEC Standards and Specifications, and all applicable building codes and other public agencies having jurisdiction upon the work shall apply.
C. Workmanship: All work shall be installed in a neat, orderly, and responsible manner with the recognized standards of workmanship. The Engineer reserves the right to reject material or work which does not conform to the contract documents. Rejected work shall be removed or corrected at the earliest possible time at the Contractor's expense.
D. Operation and Maintenance Manuals: The Contractor shall prepare and deliver to the Engineer within ten (10) calendar days prior to completion of construction a minimum of three (3) hard cover binders, with three rings and a USB with the electronic design files (including the irrigation As Builts), containing the following information:
    1. Index sheet stating the Contractor's address and business telephone number, twenty-four (24) hour emergency phone number, person to contact, list of equipment with name(s) and address(es) of

local manufacturer's representative(s) and local supplier where replacement equipment can be purchased.
2. Catalog and part sheet on every material and equipment installed under this contract.
3. Complete operating and maintenance instructions on all major equipment.
4. Provide the Engineer and the city maintenance staff with a written the Operations Manual and "hands on" training for major equipment and show evidence in writing to the Engineer at the conclusion of the project that this service has been rendered.
    a. Four-hour instruction (minimum) for the Irrigation Zones equipment operation and maintenance.
    b. Two-hour instruction (minimum) for automatic control valve operation and maintenance.

902-1.1.2. PROJECT CONDITIONS

A. The Contractor shall coordinate the work with all other trades, all underground improvements, the location and planting of trees and all other planting. Verify planting requiring excavation of twenty-four-inch (24") diameter and larger with the Engineer prior to installation of main lines.
B. Provide temporary irrigation at all times to maintain plant materials during the construction period.
C. The Contractor is responsible to maintain the work area and equipment until final acceptance by the Engineer. Repairs and replacement of equipment broken, stolen, or missing as well as regular maintenance operations shall be the obligation of the Contractor.
D. The Contractor shall submit a traffic control plan (per FDOT specifications) to the Engineer prior to initiating construction on the site. The Contractor shall be responsible for the maintenance of traffic signs, barriers, and any additional equipment to comply with the FDOT standards and to ensure the safety of its employees and the public.

902-1.1.3. WARRANTY

A. The Contractor(s) shall warrant the irrigation system components to give satisfactory service for one (1) year period from the date of acceptance by the Engineer and the city. Should any problems develop within the warranty period due to inferior or faulty materials, the Contractor shall be corrected at no expense to the city.

902-1.2. PRODUCTS

902-1.2.1. GENERAL

A. All materials throughout the system shall be new and in perfect condition. No deviations from the specifications shall be allowed except as noted.

902-1.2.2. PIPING

A. The irrigation system pipe shall be as stated herein and shall be furnished, installed and tested in accordance with these specifications.
B. All pipe is herein specified to be Polyvinyl Chloride (PVC) Pipe, 1120, Schedule 40, conforming to ASTM D2665 and D1785.
C. All nipples, pipe connections, bushings, swing joints, connecting equipment to the mainline is required to be threaded Polyvinyl Chloride (PVC) Pipe, Schedule 80 per detail drawings.

902-1.2.3. PIPE FITTINGS

A. All pipe fittings for Schedule 40 PVC pipe shall be as follows: Fittings shall conform to the requirements of ASTM D2466, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval. The connection of mainline pipe

to the automatic control valve shall be assembled with threaded Schedule 80 fittings and threaded Schedule 80 nipples.

902-1.2.4. PVC PIPE CEMENT AND PRIMER

A. Provide solvent cement and primer for PVC solvent weld pipe and fittings as recommended by the manufacturer. Pipe joints for solvent weld pipe to be belled end. Submit to the city Project Manager for approval. The solvent that cement that should be used is 303 PVC Cement Regular Clear.
B. Purple primer shall be applied after the pipe and fittings have been cut and cleaned. The Primer shall be of contrasting color and be easily recognizable against PVC pipe. The purple primer cleaner for PVC is 8800.

902-1.2.5. THREADED CONNECTIONS

A. Threaded PVC connections shall be made using Teflon tape or Teflon pipe sealant.

902-1.2.6. GATE VALVES

902-1.2.6.1. MANUAL GATE VALVES TWO INCHES (2”) AND SMALLER

A. Provide the following, unless otherwise noted on Drawings:
   1. 200-250 psi Ball Valve
   2. Nibco Brass Body Construction, female threaded on both sides, sized appropriately to source pipe - with Teflon Ball Seals
   3. Slip/Threaded Coupler
   4. Schedule 80 Nipple

902-1.2.6.2. GATE VALVES TWO AND A HALF INCHES (2½") AND LARGER

A. Provide the following, unless otherwise noted on Drawings:
   1. AWWA-C509
   2. 200 lb. O.W.G.
   3. Cast Iron body - ASTM A 126 Class B
   4. Deep socket joints
   5. Rising stem
   6. Bolted bonnet
   7. Double disc
   8. Equipped with two inches (2") square operating key with tee handle
B. Provide two (2) operating keys for gate valve three inches (3") and larger. The “street key” shall be five feet (5') long with a two inch (2") square operating nut.

902-1.2.7. SLEEVES

A. Sleeves: (Existing by city of Clearwater)
   1. The Contractor shall verify the location of all existing sleeves as shown on the roadway, utility and/or irrigation plans and notify the Engineer of any discrepancies.
B. Schedule 80 or higher, sized two (2) times the diameter of pipe to be sleeved

902-1.2.8. REMOTE CONTROL VALVES

A. The electric globe remote control valve shall be a solenoid actuated; balance-pressure across-the-diaphragm type capable of having a flow rate per manufacturer’s recommendations with a pressure loss not to exceed 6.1 pounds per square inch (psi). The valve pressure rating shall not be less than 150 psi. Submit to the city Project Manager for approval.

B. The valve body and bonnet shall be constructed of high impact weather resistant plastic, stainless steel, and other chemical/UV resistant materials. The valve's one-piece diaphragm shall be of durable santoprene material with a clog resistant metering orifice.
C. The valve body shall have a one-inch (1"), 1 1/2'', 2'', 3'' (FNPT) inlet and outlet or a one-inch (1") female threaded inlet and outlet for threaded connections.
D. The valve construction shall be as such to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.
E. The valve shall be as manufactured by Irritrol or approved equal. Any valve that is 3'' or larger than must submit to the city Project Manager for approval.
F. Identify all control valves using Aluminum or Bronze metal I.D. tags numbered to match drawings.
G. All electric valves to have gate valves on source side of each valve.

902-1.2.9. VALVE BOXES

A. For electronic irrigation valves use a Brooks #36 concrete valve box with #36-T cast iron traffic bearing cover or approved equal.
B. For wire splices and gate valves use a Carson with T cover (Heavy Duty) ten inch (10") circular valve box with #181015 cover comparable to Brooks or approved equal. The color of the lids need to be Pantone 522C if reclaimed.

902-1.2.10. AUTOMATIC CONTROL TIMER

A. The irrigation controller (control module) shall be programmable by a separate transmitter device only. The program shall be communicated to the Control Module from the Field Transmitter via an infrared connection. The controller shall be of a module type which may be installed in a valve box underground. The controller shall function normally if submerged in water and the communication from the transmitter shall function if submerged in water.
B. The control module shall be housed in an ABS plastic cabinet and shall be potted to insure waterproof operation. The control module shall have two mounting slots for screws allowing the module to be securely mounted inside a valve box.
C. The controller shall operate on one nine volt (9V) alkaline battery for one full year regardless of the number of stations utilized. The controller shall operate 1, 2, or 4 stations either sequentially or independently.
D. The controller shall have three (3) independent programs with eight (8) start times each, station run time capability from one (1) minute to twelve (12) hours in one (1) minute increments, and a seven (7) day calendar. The controller shall turn on stations via latching solenoids installed on the valves. Manual operations shall be initiated by attaching the Field Transmitter to the Control Module and programming a manual start. The controller shall be capable of manual single station or manual program operation.
E. The controller shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California USA. Submit to the city Project Manager for approval.

902-1.2.11. FIELD TRANSMITTER

A. The irrigation controller shall be programmable by a separate transmitter device (Field Transmitter) only. The Field Transmitter shall communicate to the Control Module via an infrared connection or over air. The Field Transmitter shall be water resistant and housed in ABS plastic and have a removable, reversible protective sheath. The Field Transmitter shall operate on one nine volt (9V) alkaline battery.
B. The Field Transmitter shall have a large LCD screen and a seven-key programming pad. A beep sound shall confirm every key stroke. The screen shall automatically turn off after one minute when not in use.
C. The Field Transmitter shall be capable of programming an unlimited number of UNIK Control Modules or A/C placed times, whichever is applicable.

D. The Field Transmitter shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California USA.
E. Field transmitter to be provided to city Parks and Recreation at time of acceptance of project.
F. Submit to the city Project Manager for approval.

902-1.3. EXECUTION

902-1.3.1. GENERAL INSTALLATION REQUIREMENTS

A. Before work is commenced, hold a conference with the Engineer to discuss general details of the work.
B. Verify dimensions and grades at job site before work is commenced.
C. During the progress of the work, a competent superintendent and any assistants necessary shall be on site, all satisfactory to the Engineer. This superintendent shall not be changed, except with the consent of the Engineer. The superintendent shall represent the Contractor in Contractor's absence and all directions given to the superintendent shall be as binding as if given to the Contractor.
D. Obtain and pay for all irrigation and plumbing permits and all inspections required by outside authorities.
E. All work indicated or notes on the Drawings shall be provided whether or not specifically mentioned in these Technical Specifications.
F. No irrigation piping or any irrigation component shall be installed in a retention pond bottom or slopes or passing through retention pond. No piping shall be 12'' from top of bank.
G. If there are ambiguities between the Drawings and Specifications, and specific interpretation or clarification is not issued prior to bidding, the interpretation or clarification will be made only by the Engineer, and the Contractor shall comply with the decisions. In the event the installation contradicts the directions given, the installation shall be corrected by the Contractor at no additional cost.
H. Layout of sprinkler lines shown on the Drawing is diagrammatic only. Location of sprinkler equipment is contingent upon and subject to integration with all other underground utilities. Contractor shall employ all data contained in the Contract Documents and shall verify this information at the construction site to confirm the manner by which it relates to the installation.
I. Do not proceed with the installation of the sprinkler system when it is apparent that obstructions or grade differences exist or if conflicts in construction details, legend, or specific notes are discovered. All such obstructions, conflicts, or discrepancies shall be brought to the attention of the Engineer.
J. The disturbance of existing paving will not be permitted. Install all required sleeving prior to roadway base installation.

902-1.3.2. EXCAVATING AND BACKFILLING

902-1.3.2.1. TRENCHING - GENERAL

A. Dig sides of trenches straight(vertically). Provide continuous support for pipe on bottom of trenches. Lay pipe to uniform grade. Trenching excavation shall follow layout indicated on Drawings.
B. Maintain six inch (6") horizontal and minimum clearance between sprinkler lines and between all lines of other trades.
C. Do not install sprinkler lines directly above another line of any kind.
D. Maintain six inch (6") vertical minimum between sprinkler lines which cross at angles of 45° to 90°.
E. Exercise care when excavating, trenching, and working near existing utilities.

902-1.3.2.2. BACKFILLING

A. All pressure supply lines (mainline) shall have eighteen inches (18") of fill placed over the pipe.
B. Initial backfill on all lines shall be of a fine granular material with no foreign matter larger than one half inch (½").
C. Compact backfill according to Section 125 of FDOT Standard Specifications.

D. Do not, under any circumstances, use equipment or vehicle wheels for compacting soil.
E. Restore grades and repair damages where settling occurs before landscape installation begins.
F. Compact each layer of fill with approved equipment to achieve a maximum density per AASHTO T180. Under landscaped areas, compaction shall not exceed 95% of maximum density.
G. Compaction shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than six inches (6") thick. The hand tampers shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent damage to the irrigation system piping and adjacent utilities.

902-1.3.2.3. ROUTING OF PIPING

A. Routing of pressure and non-pressure piping lines are indicated diagrammatically on Drawings.
B. Coordinate specimen trees and shrubs with routing of lines.
   1. Planting locations shall take precedence over sprinkler and piping locations.
   2. Report to Engineer and/or city any major deviation from routing indicated.
C. Conform to Drawings layout without offsetting the various assemblies from the pressure supply line.
D. Layout all systems using an approved staking method and maintain the staking of approved layout.

902-1.3.3. INSTALLATION

902-1.3.3.1. WATER SUPPLY

A. Connections to the water sources shall be at the approximate locations indicated on the Drawings. Make minor changes caused by actual site conditions without additional cost to the city.

902-1.3.3.2. ASSEMBLIES

A. Routing or pressure supply lines as indicated on Drawings is diagrammatic only. Install lines and required assemblies in accordance with details on Drawings.
B. Do not install multiple assemblies on plastic lines. Provide each assembly with its own outlet. When used, the pressure relief valve shall be the last assembly.
C. Install all assemblies in accordance with the respective detail Drawings and these Technical Specifications.
D. Plastic pipe and threaded fittings shall be assembled using Teflon tape, applied to the male threads only.

902-1.3.3.3. SLEEVES: (EXISTING BY CITY OF CLEARWATER)

A. The Contractor shall verify the location and size of all existing sleeves as shown on the roadway, utility and/or irrigation plans and notify the Engineer of any discrepancies before work begins.

902-1.3.3.4. PLASTIC PIPE

A. Install plastic pipe in accord with manufacturer's recommendations.
B. Prepare all welded joints with manufacturer's cleaner prior to applying solvent.
   1. Allow welded joints as least fifteen (15) minutes setup/curing time before moving or handling.
   2. Partially center load pipe in trenches to prevent arching and shifting when water pressure is on.
   3. Do not permit water in pipe until a period of at least four (4) hours has elapsed for solvent weld setting and curing, unless recommended otherwise by solvent manufacturer.
C. Curing
   1. When the temperature is above 80°F, allow soluble weld joints at least twenty-four (24) hours curing time before water is introduced under pressure.
D. Flushing the system:
   1. After all sprinkler pipelines and risers are in place and connected, open the control valves and flush out the system with a full head of water.
E. Installing piping under existing pavement:

1. Piping under existing pavement may be installed by jacking & boring. Refer to *Section 503-2.3. of these Technical Specifications.*
2. Secure permission from the city Landscape Architect before cutting or breaking any existing pavement. All repairs and replacements shall be approved by city and shall be accomplished at no additional cost.

902-1.3.3.5. CONTROLLERS

A. Install all automatic controllers as shown in the plans.
   1. The location of all controllers shall be approved by the city's Project Manager and/or Representative prior to installation.

902-1.3.3.6. REMOTE CONTROL VALVES

A. Install at final grade. Set in turf areas whenever possible.
B. Install valves in turf areas in a plumb position with twenty-four inch (24") minimum maintenance clearance from other equipment, three feet (3') minimum from edges of sidewalks, buildings, and walls, and no closer than seven feet (7') from the back of curb or edge of pavement along roadways.
C. Contractor shall adjust the valve to provide the proper flow rate or operating pressure for each sprinkler zone.

902-1.3.3.7. GATE VALVES

A. Install where indicated and with sufficient clearance from other materials for proper maintenance.
B. Check and tighten valve bonnet packing before backfilling.
C. Install in 10'' round, Carson Heavy Duty valve box or approved equal (Pantone 522C if reclaim).

902-2. LANDSCAPE

902-2.1. GENERAL

902-2.1.1. REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with Federal, State, Local, and other duly constituted authorities, and regulatory agencies, without additional cost to the city in matters pertaining to codes, safety, and environmental matters.
B. Any permits for the installation or construction of any of the work included under the contract, which are required by any of the legally constituted authorities having jurisdiction, shall be arranged for by the Contractor and paid for directly by the Contractor, unless otherwise agreed upon in writing.

902-2.1.2. SCOPE OF WORK

A. All provisions of Contract, including General and Special Provisions and Plans, apply to the work specified in this Section. The Scope of Work includes everything for and incidental to executing and completing all landscape work shown on the Plans, Schedules, Notes and as specified herein.
B. Furnish and provide all labor, plants and materials tools and equipment necessary to prepare the soil for plantings, to install and care for all plant materials (including finish grading if necessary); to remove and/or transplant existing plants if indicated; to furnish, plant, fertilize, guy and brace, water, mulch and prune all new plant materials; and to execute all other Work as described herein or indicated on the Plans.
C. Work under this Section shall include labor and materials for final grading and raking to prepare the site for sodding, sprigging, or seeding, so finished lawn or playing field will appear even and uniform, will drain adequately, and will comply with the intent of the landscape drawings.
D. Initial maintenance of landscape materials as specified in this document.

902-2.1.3. QUALITY ASSURANCE

A. Landscape work shall be contracted to a single firm specializing in landscape work, who shall in turn subcontract no more than 40% of the work specified. All subcontractors under the control of the Contractor involved in the completion of the landscape work, shall be made known to the city and the city Landscape Architect prior to their commencement of work on the project.
B. All work of this Section shall conform to the highest standard of landscape practices.
C. The Plant Material Schedule included with these Plans is provided only for the Contractor's convenience; it shall not be construed as to conflict or predominate over the Plans. If conflict between the Plans and Specifications exists, submit to the city Project Manager for approval.
D. During this work, the Contractor shall be responsible for maintaining safety among persons in their employ in accordance with the standards set by The Occupational Safety and Health Act of 1970 (and all subsequent amendments). City and city Landscape Architect shall be held harmless from any accident, injury or any other incident resulting from compliance or non-compliance with these standards.
E. The Contractor shall cooperate with and coordinate with all other trades whose work is built into or affects the work in this Section.
F. All appropriate utility companies and agencies shall be contacted 72 hours prior to excavation. Call "One Call"/ "Sunshine 811" at 8-1-1; "Sunshine 811" administrative offices may be reached at (800) 638-4097.
G. The Contractor shall carefully examine the site and all existing conditions affecting the work, such as: soil, obstructions, existing trees, utilities, etc. Report any conditions in conflict with the work to the Landscape Architect.

902-2.1.4. SUBMITTALS

A. The Contractor is required to submit prior to the expiration of the required maintenance period, two (2) copies of typewritten instructions recommending procedures to be established by the Contractor for maintenance of landscape work for a period of one (1) year.
B. Furnish unit prices for all plant materials and inert materials, including labor for all specified work.

902-2.1.5. ALTERNATES, ADDITIONS, DELETIONS, SUBSTITUTIONS

A. If there are additions/alternates included in these Plans and Specifications, the Contractor must propose prices to accomplish the work stated as additions/alternates at the time of bidding.
B. The city, through their Project Manager, reserves the right to add or deduct any of the work stated herein without rendering the Contract void.
C. The Contractor must have written approval by the city Project Manager for any substitutions not previously agreed to in the purchase agreement: installation without approval is entirely at the Contractor's risk.
D. All material acquired through additions or substitutions shall be subject to all conditions and warranties stated herein.

902-2.1.6. ABBREVIATIONS/DEFINITIONS

O.A. or HT.: The over-all height of the plant measured from the ground to the natural, untied state of the majority of the foliage, not including extreme leaves, branches or fronds.

C.T.: Clear trunk is measured from the ground to the bottom of the first leaf or frond stem with no foliage from ground to specified height. For example, on Canary Island Date Palms or similar, the clear trunk measurement includes the "nut" at the base of the fronds.

C.W.: Clear wood is measured from the ground to the bottom of the base of the lowest leaf sheath or boot, trimmed in a natural manner. For example, on Canary Island Date Palms or similar, the clear wood measurement does not include the "nut" at the base of the fronds.

SPR.: Spread, branches measured in natural untied position to the average crown diameter, not including extreme leaves, branches, or fronds.

ST.TR.: Straight trunk.

MIN.: Minimum.

GAL.: Gallon container size, i.e., 1 gallon, 3-gallon, 7 gallons, etc.

O.C.: On center, distance between plant centers.

DIA.: Diameter.

LVS.: Leaves.

D.B.H.: Diameter or caliper of main trunk of tree as measured at breast height at 4-1/2 feet above grade.

CAL.: Caliper, the outside diameter of up to a four-inch tree is measured six inches above grade, larger trees are measured at 12 inches above grade.

B&B: Balled and burlapped in accordance with horticultural standards of the American Association of Nurserymen.

PPP: Plants per pot.

FG: Field grown.

STD.: Standard, single, straight trunk.

Owner: To be known as that entity which holds title or control to the premises on which the work is performed.

Owner's Representative: Owner's on-site representative shall be responsible for approval of quantity and quality of materials specified and execution of installation.

Contractor: Shall refer to that person or enterprise commonly known as the Landscape Contractor.

Landscape Architect: This person or firm is the responsible representative of the Owner who produces the landscape Plans and Specifications.

902-2.1.7. PRODUCT DELIVERY, STORAGE, AND HANDLING

902-2.1.7.1. PLANT MATERIALS

A. Use Florida Grades and Standards (most current edition) for all plant materials within these Technical Specifications.
B. Provide container-grown or, if appropriate, freshly dug trees and shrubs. Do not prune prior to delivery. Do not bend or bind trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery. If plant delivery is made in open vehicles, the entire load shall be suitably covered.
C. All plants are to be handled at all times so that roots or root balls are adequately protected from sun, cold, or drying winds. No root balls for trees and container plants that have been cracked or broken shall be planted except upon special approval. Plants shall not be pulled by the tops or stems, nor handled in a rough or careless manner at any time.
D. Trees shall be dug with adequate root balls, burlapped, and wire bound if needed. Root pruning to be done a minimum of four (4) weeks before removal from the field and planting at the site. Root balls

may not be encased in "grow bags" or other synthetic material, except plastic shrink wrap for transport only.

E. Palms shall be planted within twenty-four (24) hours of delivery.
F. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and cover to keep the roots moist.
G. Label all plants of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.
H. Time delivery so that sod will be placed within twenty-four (24) hours after stripping. Protect sod against drying and breaking by covering palettes of sod or placing in a shaded area.

902-2.1.8. JOB CONDITIONS

902-2.1.8.1. ACCEPTANCE OF JOB CONDITIONS.

A. The Contractor shall examine the sub-grade, verify elevations, observe the conditions under which work is to be performed and notify the city Landscape Architect or Project Manager in writing of unsatisfactory conditions prior to beginning work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the city Landscape Architect. Start of work shall indicate acceptance of conditions and full responsibility for the completed work.
B. Proceed with and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work and following the approved schedule. If seasonal limitations apply, notify the city Landscape Architect for adjustments to the Schedule.
C. Determine locations of all underground utilities and review for conflicts with planting procedures before plant installations begin.
D. When adverse conditions to plant growth are encountered, such as rubble fill, drainage conditions or obstruction, the Contractor shall notify the city Landscape Architect in writing for change approval before work is performed
E. Plant trees and shrubs after final grades are established and prior to sod installation or seeding lawns. Protect existing lawn, trees, and promptly repair all damages from planting operations that is satisfactory and approved by the city.

902-2.1.8.2. SCHEDULING OF WORK

A. The work shall be carried out to completion with the utmost speed. Immediately upon award of contract, the Contractor shall prepare a construction schedule and furnish a copy to the city's Project Manager and/or the city Landscape Architect for approval. The Contractor shall carry out the work in accordance with the approved schedule.
B. If the Contractor incurs unforeseen costs, such as overtime hours, holidays, etc., in order to complete the work within the time stated in the Contract, and/or to maintain the progress schedule, all said costs shall be borne by the Contractor at no additional cost to the city.
C. The city's Project Manager and/or Representatives may request work stoppage in writing. Upon written request from the city's Project Manager, the Landscape Contractor shall suspend delivery of material and stop all work for such a period as deemed necessary by the city of Clearwater, the city's Project Manager, or the General Contractor, with respect to any additional costs which may result from work stoppage.

902-2.1.8.3. UTILITIES

A. The Contractor shall perform work in a manner which will avoid conflicts with utilities. Hand excavate, as required, to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.

902-2.2. PRODUCTS

902-2.2.1. MATERIALS

902-2.2.1.1. PLANT MATERIALS: NOMENCLATURE

A. Plant species, sizes, etc., shall be per Plans and Specifications on Plant Material Schedule. Nomenclature is per Manual of Cultivated Plant, Standard Encyclopedia of Horticulture, L.H. Bailey, or Standardized Plant Names Dictionary, American Joint Committee on Horticultural Nomenclature (latest editions) or conforms with names accepted in the nursery trade. The scientific and common name both need to be provided for each plant materials.

902-2.2.1.2. PLANT MATERIALS: QUALITY ASSURANCE

A. Use Florida Grades and Standards (latest edition) for all plant materials within these Technical Specifications.

B. Provide healthy, vigorous stock grown under climatic conditions similar to conditions in the locality of the project. Plants shall have a habit of growth that is normal for the species and be sound, healthy, vigorous, and free from insects, pests or their eggs, plant diseases, defects and injuries. Plants shall be well branched and densely foliated when in leaf and shall have healthy, well-developed root systems.

C. Trees shall be heavily branched or, in the case of palms, be heavily leafed. Some plant materials may be collected stock with the approval of the Landscape Architect. Tree species must have a single main trunk (central leader), unless otherwise stated. Trees that have the main trunk forming a "Y" shape or parallel branching are not acceptable.

D. Plant materials shall be specified and shall be Florida #1 or better as to shape and quality for the species as outlined in Grades and Standards for Nursery Plants Part I and II, Florida Department of Agriculture and Consumer Services (latest edition).

E. The city Landscape Architect reserves the right to inspect plant materials either at the place of growth or at the project site prior to planting for compliance with requirements for name, variety, size, quality, or designated area.

F. Landscape materials shall be shipped with certificates of inspection as required by governmental authorities. The Contractor shall comply with all governing regulations that are applicable to landscape materials.

G. Do not make substitutions. If specified landscape material is not available, submit to the Landscape Architect proof of it being non-available. In such event, if the Landscape Architect designates an available source, such shall be acquired from designated source. When authorized, a written change order for substitute material will be made by adjustment to Contract amount.

H. Height and/or width of trees shall be measured from ground up; width measurement shall be normal crown spread of branches with plants in the normal position. This measurement shall not include immediate terminal growth. All measurements shall be taken after pruning for specified sizes. All trees and shrubs shall conform to measurements specified in the plant material schedule, except that plant material larger than specified may be used with the approval of the city Landscape Architect, with no increase to the Contract price. Plant materials shall not be pruned prior to delivery.

I. Plant Material shall be symmetrical, typical for variety and species. Plants used where symmetry is required shall be matched as nearly as possible.

J. Balled and burlapped plants shall have firm, natural balls of earth of sufficient diameter and depth to encompass the feeding root system necessary for full development of the plant and to conform with the standards of the American Association of Nurserymen. Root balls and tree trunks shall not be damaged by improper binding and B & B procedures. Only natural biodegradable burlap will be acceptable.

K. Container-grown plants may be substituted for balled and burlapped plants or vice-versa provided the quality is equal or better than specified and the Landscape Architect approves the substitution.

L. Container-grown stock shall have been grown in containers for at least four months, but not over two years. If requested, samples must be shown to prove no root bound condition exists.

902-2.2.1.3. GRASSES: SOD OR SEED

A. Sod or seed (as/if specified) shall be a certified species as stated on the Plan. Solid sod shall be of even thickness and with a good root structure, 95% free of noxious weed, freshly mowed before cutting, and pest and disease free when laid. It must not be stacked more than twenty-four (24) hours before laying and it must be grown in soil compatible to that in which it will be installed. Sod must be kept moist prior to and after installation through the acceptance of the project.
B. Sod shall be laid side to side with no gaps and all at level grade, so no scalping occurs. Contractor will make changes as deemed necessary by the city before acceptance of work.
C. Seed shall be delivered to the site in unopened bags with certification tags in place. Purity, germination and weed content shall be as certification requirements.

902-2.2.1.4. MULCH

A. Mulch shall be as specified in the plans
B. Install mulch to an even depth of three inches (3”) before compaction, as shown in the PLANTING DETAILS in the plans.

902-2.2.1.5. STAKES AND GUYS

A. Use the University of Florida Urban Tree Foundation Planting Details and Specifications Staking details. Use the latest edition of the Staking Details from the Urban Tree Foundation (http://urbantree.org/details_staking.shtml)
B. For single trunk palms, stakes shall be cut from 2” x 4” pressure treated (p.t.) stock, with a minimum of three (3) stakes per palm. Batten consisting of 5 layers of burlap and 5 - 2” x 4” by 16” wood connected with two – three-quarter inch (¾”) steel bands shall be used around the palm trunk. Submit to the city Project Manager for approval.
C. Other tree staking systems may be acceptable if approved.

902-2.2.1.6. PLANTING SOIL

A. Unless stated on the plans or in the specifications, install plant material in tilled and loosened native soil backfill. It is the responsibility of the Landscape Contractor to test, prior to planting and at no additional cost to the city, any soils which may be unsuitable for the vigorous growth of plants. Unsuitable conditions shall be reported to the Landscape Architect immediately in writing.
B. When required, planting soil media shall be provided by the Contractor and shall consist of one-third (1/3) peat and two-thirds (2/3) sandy loam, with no lumps over one inch (1”).
C. Backfill and clean fill dirt provided by the Contractor shall be in a native, friable soil with known analysis and composition that is like soil makeup. There must be slight acid reaction to the soil (about 6.0 – 6.5 pH) with no excess of calcium or carbonate, and it shall be free from weeds, clay, stones, stumps, roots and toxic substances or any other materials that might be harmful to plant growth or a hindrance to grading, planting, and maintenance procedures and operations. No heavily organic soil, such as muck or peat shall be used as fill dirt.

902-2.2.1.7. TREE PROTECTION

A. Wood fencing shall be 2” x 4” pressure treated stock with flagging on horizontal members. Space vertical members six feet (6’) to eight feet (8’) on center. The barricade shall be placed so as to protect the critical protection zone area, which is the area surrounding a tree within a circle described by a radius of one foot (1’) for each inch of the tree’s diameter at breast height DBH (four and one half feet) above grade.

902-2.2.1.8. ROOT BARRIER SYSTEM

A. Submit to city Project Manager and Landscape Architect for approval (if applicable).

902-2.2.1.9. PACKAGED MATERIALS

A. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site.

902-2.2.1.10. PESTICIDES

A. Pesticides shall be only approved, safe brands applied according to manufacturer's directions.

902-2.3. EXECUTION

902-2.3.1. PREPARATION

902-2.3.1.1. OBSTRUCTIONS BELOW GROUND

A. It shall be the responsibility of the Contractor to locate and mark all underground utilities, irrigation lines and wiring prior to commencement of the work.
B. If underground construction, utilities, or other obstructions are encountered in excavation of planting areas or pits, the city Project Manager and Landscape Architect shall be immediately notified to select a relocated position for any materials necessary.

902-2.3.1.2. GRADING AND PREPARATION FOR PLANT MATERIALS

A. All proposed landscape areas containing existing turf grass or weeds shall be treated with mutually agreed on herbicide per manufacturer's specifications. All proposed landscape areas adjacent to water bodies shall be treated with "Rodeo" or approved equal per the manufacturer's specifications.
B. New plant materials will not be installed until 98% weed/turf eradication has been achieved. More than one application may be required to produce an acceptable planting bed.
C. Pre-emergent herbicides are not a substitute for spray treatment of "Rodeo" or approved equal and may be used only with the written approval of the Landscape Architect.
D. Should any plant material in the same or adjacent beds be damaged by these chemicals, the same size, quantity, and quality of plants shall be immediately replaced by the Contractor at no cost to the city.
E. Any necessary corrections or repairs to the finish grades shall be accomplished by the Contractor. All planting areas shall be carefully graded and raked to smooth, even finish grade, free from depressions, lumps, stones, sticks or other debris and such that they will conform to the required finish grades and provide uniform and satisfactory surface drainage without puddling.
F. The Contractor shall remove debris (sticks, stones, rubbish) over one- and one-half inches (1½") in any dimension from individual tree, shrub and hedge pits and dispose of the excavated material off the site.

902-2.3.1.3. PREPARATION FOR ANNUAL BED PLANTING

A. Prepare native subgrade by rototilling or loosening by hand methods. Spread three inches (3") of one-third (1/3) Florida peat and two-thirds (2/3) sandy, or other approved organic soil amendment over the full length and width of planting area for annuals. Rototill organic layer six inches (6") to eight inches (8") into the native soil. Grade the planting bed by "crowning' to ensure that surface drainage, percolation, and aeration occur at rapid rates.

902-2.3.1.4. PREPARATION FOR SEEDING AND SOD AREAS

A. All proposed sod areas containing existing turf grass or weeds shall be treated with Monsanto's "Round-Up" per manufacturer's specifications. All proposed sod areas adjacent to water bodies shall be treated with "Rodeo" per the Manufacturer's Specifications.

B. Limit preparation to areas which will be planted promptly after preparation. Loosen sub-grade of seed and sod areas to a minimum depth of four inches (4”).
C. Immediately prior to any turf work, the Contractor shall finish grade the soil to a smooth, even surface assuring positive drainage away from buildings and the subsequent turf flush to the tops of adjacent curbs and sidewalks. The surface shall be sloped to existing yard drains.
D. Moisten prepared seed and sod areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

902-2.3.2. INSTALLATION

902-2.3.2.1. BERM CONSTRUCTION (IF SPECIFIED)

A. Install berms at location and design shown on Plans and at the height and slope indicated. Height stated is for finished berm with soil at natural compaction.
B. Exact location and configuration of berms may require modification to allow proper drainage; such changes will be coordinated with the Landscape Architect.
C. If shown on the Plan, construct berms using clean sandy loam fill dirt which is well-drained, free of rocks, roots, or other debris, with a soil pH of an acid Nature (about 6.0 - 6.5). No heavily organic soil, such as muck or peat shall be used in berm construction.

902-2.3.2.2. LAYOUT OF PLANT MATERIALS

A. Unless otherwise stipulated, plant materials shall be approximately located per the plans by scale measurements using established building, columns, curbs, screen walls, etc., as the measuring reference point. Slight shifting may be required to clear wires, prevent blockage of signage, etc.
B. Shrubs and ground covers shall be located and spaced as noted on the plant material schedule
C. Leave an eighteen-inch (18”) (450 millimeters) borders of mulched space between outer leaves of installed plant material and the bed line, curb, or building foundation wall for all plant sizes.
D. Any necessary “minor” adjustments in the layout of planting shall be made by the Contractor with the approval of the city Project Manager and Landscape Architect in order to conform as nearly as possible to the intent of the Plans.

902-2.3.2.3. PLANTING PROCEDURES

A. All shrubs, trees and ground covers or vines shall be planted in pits having vertical sides and being circular in outline. Planting pit shall be two (2) times the width of the root ball.
B. Plants shall be set straight or plumb, in the locations shown, planted “high” with10% of the root ball height above the surrounding grade.
C. Native soil shall be used in back-filling plant pits or as specified. The Contractor shall be responsible for providing additional soil for building tree saucers.
D. When balled and burlapped plants are set, undisturbed native soil shall be left under the base of the root ball to prevent voids. Backfill loosened native soil around the sides of the root ball. Remove the top 4 four inches (4”) (100 millimeters) of burlap wire, and all tie-down material from the root ball. Do not remove these materials from the bottom of the root ball. Thoroughly water-in before bringing the back-fill up to the proper grade. Use the Florida Grades and Standards (latest edition). Failure to comply is cause for rejection.
E. Containerized plants shall be installed with undisturbed native soil left under the base of the root ball to prevent voids. Planting pit shall be three (3) to five (5) times the width of the root ball. Backfill tilled and loosened native soil around the sides of the root ball. Thoroughly water-in before bringing the backfill up to the proper grade.
F. Plant spacing shall be “on center” and varies with the different plant species. Space each variety of plant equally in the planting areas. Shrubs and ground cover adjacent to straight or curved edges shall be triangular - spaced in rows parallel to those edges. Plant a minimum of eighteen inches (18”) from the back of the curb to the outside edge of the plant.

902-2.3.2.4. SODDING

A. During periods of drought, sod shall be watered sufficiently at its origin to moisten the soil adequately to the depth to which it is to be cut.
B. Solid sod shall be laid tightly with closely abutting staggered joints with an even surface edge and sod edge, in a neat and clean manner to the edge of all the paving and shrub areas. Cut down soil level to one inch (1") to one- and one-half inches (1-1/2") below top of walks prior to laying sod.
C. Within two (2) hours after installing sod and prior to rolling, irrigate the sod. Sufficient water shall be applied to wet the sod thoroughly and to wet the sod to a depth of two inches (2") (50 millimeters). Watering shall be done in a manner that will avoid erosion due to the application of excessive quantities, and the watering equipment shall be a type that will prevent damage to the finished sod surface. Watering shall be repeated as necessary to keep sod moist until rooted to subgrade.
D. The sod shall be pressed firmly into contact with the sod bed using a turf roller or other approved equipment so as to eliminate air pockets, provide a true and even surface and insure knitting without any displacement of the sod or deformation of the surfaces of sodded areas. After the sodding operation has been completed and rolled, the edges of the area shall be smooth and conform to the grades indicated.
E. If, in the opinion of the Landscape Architect, top dressing is necessary after rolling, clean silica sand shall be used to fill voids. Evenly apply sand over the entire surface to be leveled, filling-in dips and voids and thoroughly washing into the sod areas.
F. On slopes 3:1 or steeper, and as required, a geotextile fabric shall be installed per manufacturer's specifications prior to placing sod. The sod shall be fastened in place with suitable wooden pins or by other approved method.

902-2.3.2.5. SEEDING

A. Seed shall be installed per the specifications of the State of Florida Department of Transportation. See plan for type of seed.

902-2.3.2.6. TREE GUYING, BRACING AND STAKING

A. Use the latest edition of the Staking Details from the Urban Tree Foundation (http://urbantree.org/details_staking.shtml). Submit to the city Project Manager for approval.
B. Contractor shall remove all tree guying, staking, and bracing from trees 1 year after the date of final acceptance of the landscape work.

902-2.3.2.7. MULCHING

A. All planting beds shall be weed-free prior to mulching.
B. All plant beds and tree rings shall be mulched evenly with a three inch (3") layer (before compaction) of 1.5'' round pine bark nuggets or brown shredded hard wood mulch, or other mulch as specified on the Plans or General Notes. Submit to the city Project Manager for approval.
C. Mulch shall not be placed against the trunks of plant materials or foundations of buildings. Maintain a minimum six-inch (6") clearance for trees and shrub trunks and a minimum six-inch (6") clearance for the walls of buildings.

902-2.3.2.8. CLEAN-UP

A. During landscape work, store materials and equipment where directed by the city.
B. The Contractor shall promptly remove any materials and equipment used on the job, keeping the area neat at all times. Upon completion of all planting, dispose of all excess soil and debris leaving pavements and work areas in safe and orderly condition.
C. The clean-up of the site shall include the removal and proper disposal of the tree guying, staking, and bracing materials as described in specifications. No pruning should be done by the contractor, but can be done by the landscape contractor.

902-2.3.2.9. PROTECTION

A. The Contractor shall provide safeguards for the protection of workmen and others on, about, or adjacent to the work, as required under the parameters of the Occupational Safety and Health Administration (OSHA) standards.
B. The Contractor shall protect the city's and adjacent property from damage.
C. The Contractor shall protect the landscape work and materials from damage due to landscape operations. Maintain protection during installation and maintenance periods.
D. The Contractor shall provide protection (tree barricades) for all existing trees and palms as specified.

902-2.3.2.10. REPAIR OF DAMAGES

A. The Contractor shall repair all damage caused by their operations to other materials, property, or trades to a level equal in quality to the existing condition prior to damage.
B. The Contractor shall be held responsible for all damage done by their work or employees to other materials or trades' work. Patching and replacement of damaged work may be done by others, at the city's direction, but the cost of same shall be paid by the Contractor who is responsible for the damage.

902-2.3.3. MAINTENANCE

A. The Contractor shall maintain all plant materials in a first-class condition from the beginning of landscape construction until Final Acceptance.
B. Operations:
   1. Maintenance shall include, but not be limited to, watering of turf and planting beds, mowing, fertilizing, cultivation, weeding, pruning, disease and pest control, replacement of dead materials, straightening, turf or planter settlement corrections, replacement of rejected materials, staking and guying repair and tightening, wash-out repairs and regrading, and any other procedures consistent with the good horticultural practice necessary to insure normal, vigorous and healthy growth of all work under the Contract. Mowing shall be consistent with the recommended height per the University of Florida Cooperative Extension Service.
   2. Within the warranty period, the Contractor shall notify the city of any maintenance practices being followed or omitted which would be detrimental to the healthy, vigorous growth of the landscape.
   3. The Contractor shall be responsible for the final watering of not less than one inch (1") of water for all planted materials before leaving the site.

902-2.3.4. INSPECTION, REJECTION, AND ACCEPTANCE

902-2.3.4.1. INSPECTION

A. Upon completion of the installation, the Contractor will notify the city or the city's Project Manager that the job is ready for inspection. Within fifteen (15) days of notifications, the installation will be inspected by the Landscape Architect. A written and/or graphic inspection report will be sent to the city and/or Landscape Contractor.

902-2.3.4.2. REJECTION AND REPLACEMENT

A. The Landscape Architect shall be final judge as to the suitability and acceptability of any part of the work. Plant material will be rejected if it does not meet the requirements set forth in the Plans and Specifications.
B. Replace any rejected materials immediately or within fifteen (15) days and notify the Landscape Architect that the correction has been made.

902-2.3.4.3. ACCEPTANCE

A. After replacement of rejected plant material, if any, have been made, and completion of all other correction items, the city or Project Manager will accept the project in writing.

B. Upon Final Acceptance, the city assumes responsibility for maintenance within the terms of the Contract. Acceptance will in no way invalidate the Contractor's warranty period.
C. The Contractor's warranty period will begin after final acceptance of the project by the Owner.
    1. If evidence exists of any lien or claim arising out of or in connection with default in performance of this Contract, the city shall have the right to retain any payment sufficient to discharge such claim and all costs in connection with discharging such claim.
    2. Where the Specifications call for any stipulated item or an "approved equivalent", or in words to that effect, the Contractor shall indicate the price of the type and species specified in the proposal, giving the price to be added or deducted from their Contract price. The final selection rests with the city or their representative.
    3. Where plants installed do not meet specifications, the city reserves the right to request plant replacement or an appropriate deduction from the Contract amount to compensate for the value not received from the under-specified plant materials. No additional compensation will be made to the Contractor for plants installed that exceed specifications.

902-2.3.5. WARRANTY

A. The Contractor shall warranty all palms and trees furnished under this contract for a period of one (1) year and all shrubs for a period of six (6) months. Material which is either dead or in poor health during this period or at completion will be replaced at no charge to the city. Should any of the plant materials show 50% or more defoliation during the warranty period, due to the Contractor's use of poor quality or improper materials or workmanship, the Contractor upon notice, shall replace without delay same with no additional cost to the city. Should any plant require replacing, the new plant shall be given the equal amount of warranty.

903. SODDING

Unless otherwise noted herein, the Contractor shall place all sod, either shown on the plans or at the direction of the Engineer, in conformance with the latest editions of *Sections 575, 981, 982 and 983 of FDOT's Standard Specifications*. The area for sod application shall be loosened and excavated to a suitable depth and finished to a grade compatible with existing grass and structures. Sod shall be placed with edges in contact and shall be compacted to uniform finished grade with a sod roller immediately after placement. In sloped areas, the sod shall be graded and placed so as to prohibit erosion and undermining of the adjacent sidewalk. No sod that has been cut for more than seventy-two (72) hours can be used. The city shall be notified in advance by 2 business days and reserves the right to view and inspect the sod before installation. A city Project Manager shall inspect the sod at the site once delivered and will not be allowed to be laid until approved. The sod shall be thoroughly watered immediately after placement. The Contractor shall continue to water sod as needed and/or directed by the Engineer as indicated by sun exposure, soil, heat, and rain conditions, to establish and assure growth, until termination of the contract. Dead sod, or sod not acceptable to the Engineer, shall be removed and replaced by the Contractor at no additional compensation. Any questions concerning the type of existing sod shall be determined by the Engineer.

Unless otherwise noted on the plans, payment for sod (including labor, equipment, materials, placement, rolling, watering, etc.) shall be included in other bid items. Payment for these associated bid items may be withheld until the Contractor provides the city a healthy, properly placed stand of grass. When this work is given as a separate bid item, it shall cover all labor, equipment and materials, (including water) required for this work and shall be paid for on the basis of each square foot in place and accepted. No payment for sod shall be made until the Contractor provides the city a healthy, properly placed stand of grass.

904. SEEDING

Seed, or seed and mulch, shall only be used when specified for certain demolition projects. The seed and/or mulch shall be placed as called for on the plans in the following manner. The area to be seeded shall be brought to the required line and grade, fertilized, and seeded in basic conformance with *FDOT's Standard Specifications Sections 570, 981, 982 and 983*. However, no wildflower seed shall be used, and Argentine Bahia Seed shall be used instead of Pensacola Bahia. No sprigging will be required. Also, the addition of 20 lb. of Rye Seed (to total 60 lb. of seed per acre) will be required during the stated periods. It is also required that the Contractor maintain said seed until growth is assured.

When this work is given as a bid item, the item shall cover all labor, material, equipment (including water), required for this work, and shall be paid for on the basis of each square yard in place and accepted. If called for on the plans, but not shown as a bid item, then the cost of such work as stated above shall be included in the cost of other work.

905. LAWN MAINTENANCE SPECIFICATIONS

905-1. SCOPE

To remove trash and debris from landscape and paved area; maintenance and fertilization of plant beds and landscape materials; maintenance, repair, and operation of irrigation systems; ornamental pest control; palm pruning; maintenance of traffic; and the cleaning of hard surfaces at designated areas. The Contractor is to work with the city in coordinating maintenance activities and reporting irregularities in the work zone.

The Contractor(s) will provide the labor and materials required to maintain the specified landscaped street areas including:

- Traffic safety and Maintenance of Traffic.
- Trash and debris removal from the job site.
- Removal of weeds in landscaped areas and hard surfaces.
- Proper trimming and pruning of landscape plants and palms.
- Proper fertilization and pest control of landscape and palms (may be subcontracted).
- Irrigation service and repair.
- Mulch replacement.
- Cleaning of hard surfaces; and the
- Reporting of irregularities at the job site.

905-2. SCHEDULING OF WORK

The Contractor(s) shall accomplish all landscape maintenance required under the contract between the hours of 7:00 a.m. and 6:00 p.m. Monday through Saturday, excluding observed holidays. The city may grant, on an individual basis, permission to perform contract maintenance at other hours.

All work shall be completed in a continuous manner, such as cleanup, weeding, trimming, etc., be completed before leaving the job site.

905-3. WORK METHODS

905-3.1. MAINTENANCE SCHEDULING

The Contractor(s) will adhere to a work schedule provided by the city (see Level of Service). Any variations to that schedule, requested by either party, must be approved, either verbally or in writing by an authorized representative of the other party.

905-3.2. DUTIES PER SERVICE VISIT

The Contractor(s) shall provide the following service at each scheduled visit to the designated location:

905-3.2.1. LITTER AND DEBRIS

Remove trash and debris from the project site. Proper disposal of collected trash and debris is the Contractor's responsibility. Extraordinary amounts of debris caused by hurricanes, tornadoes, vandalism, etc., would be the responsibility of the city to clean up. The Contractor should report such accumulations of debris when they are encountered. Bids for the extraordinary cleanup from the Contractor would be considered. Work sites should be left in a clean and neat appearance upon completion. All debris from pruning process is to be removed from the job site and disposed of by the Contractor.

905-3.2.2. VISUAL CHECK

The site should be checked for irregularities, such as irrigation leaks, vehicle damage, dead or damaged plant material, vandalism, etc., which should be reported to the city within twenty-four (24) hours after providing the service.

905-3.2.3. PLANT TRIMMING AND PALM PRUNING

All plant material should be trimmed in a manner that promotes the natural shape and mature size of the particular species. Trimming should be performed at intervals that will maintain plants in a neat appearance. Trimming should be performed to promote fullness of the plants, while maintaining height restrictions in Clear Sight Zones as established on the landscape plans. Plants shall be kept trimmed to the back of curb. Brown foliage shall be removed from Liriope.

Palm pruning to be performed at least once per year, preferably in late June or July following flower formation, consistent with the following specification.

1. PHOENIX SPECIES (CANARY DATE, INDIA DATE, PYGMY DATE, ETC.):

   Remove all descending fronds, to the base of the frond; all parallel and ascending fronds are to remain in order to leave a full, rounded head; seed heads may remain, but remove old faded heads that are encountered in the pruning process; and remove loose frond boots; remove vegetation, such as strangler figs, Brazilian Pepper, Asparagus fern, etc., growing in the frond boots or on the trunk. Provide the rounded, classic cut on all Medjool palm boots. No climbing spikes allowed on palms.

905-3.2.3.1. TRAFFIC CONTROL

Proper and safe work zones in vehicular traffic areas are to be set up and maintained by the Contractor, according to the approved Maintenance of Traffic specifications.

905-3.2.3.2. PEDESTRIAN SAFETY

Contractor is responsible for maintaining safe work zones in areas where pedestrian and park users are present. The city reserves the right to limit the hours of operation in certain high pedestrian use areas.

905-3.2.4. WEED REMOVAL IN LANDSCAPED AREA

Weeds should be removed on a regular basis in order to keep them from being visibly noticeable. Weed control with the use of appropriate herbicides is allowable, given they are properly applied by a certified applicator. Herbicide damage to landscape material will be remedied by Contractor at their expense.

905-3.2.5. MULCH CONDITION

Should be maintained at a thickness that will discourage weed growth as well as help retain soil moisture, usually three inches (3”).

905-3.2.6. IRRIGATION SERVICE AND REPAIR

Should be performed at each visit to assure the system’s proper operation and timing. Drip tubing should be kept covered with mulch. Timer should be checked for proper time of day and operating schedule. Leaks or breaks in the system should be repaired before the next scheduled system running time.

905-3.2.7. LAWN AND ORNAMENTAL PEST CONTROL

Should be performed by a properly licensed and certified applicator to keep pest populations at a less than damaging level. Landscape materials lost to or extensively damaged by pests will be replaced by the Contractor at the Contractor’s expense. Diazinon products are not to be used on city properties.

905-3.2.8. PALM FERTILIZATION

Apply three (3) pounds of Magnesium sulfate and one pound of Potassium evenly, per tree, across the root zone (typically within the dripline), annually in early February.

905-3.2.9. FREEZE PROTECTION

The city will provide a freeze/frost protection fabric for the Contractor to install over freeze/frost sensitive plants (Lantana and Pentas). The covering material will be stored at a city facility. Contractor will remove the covering material from storage and install over the sensitive plants, securely fastening edges of the material to the ground per manufacturer’s directions. The city will furnish metal pins needed for securing fabric to the ground. The city will notify the Contractor one (1) day or twenty-four (24) hours minimum prior to the need to protect plant material. After uses, the Contractor will prepare the fabric for storage and return it to the designated city facility. Protective covering shall be removed the following afternoon or remain in place as directed by the city. The city shall notify the Contractor by 11:00 a.m. about removing the cover or keeping it in place due to continued freezing temperatures. The city may cancel the freeze protection event at any time prior to the end of the scheduled installation day (5:00 p.m.) The Contractor will be compensated for the number of hours mobilization or on-site work at the contracted rate per man-hour unit price. The Contractor shall provide a unit price for the installation and removal of the covering fabric on a per event basis, as well as an hourly rate per employee required. The city and Contractor will coordinate appropriate irrigation operations with weather conditions. Should freeze/frost damage occur, the Contractor shall perform remedial work as per unit basis, as directed by the city.

906. LEVEL OF SERVICE

The Project Site is to be serviced weekly. Repairs to damage or vandalism to be made within seven (7) working days of reported irregularity. Weekly visits should occur no closer than six (6) and no further than ten (10) calendar days apart.

907. COMPLETION OF WORK

Within twenty-four (24) hours of completing work, notify the city Project Manager either in writing of said completion and request the substantial completion letter.

908. INSPECTION AND APPROVAL

Upon receiving notification from the Contractor, the city shall inspect the serviced location the following business day. If, upon inspection, the work specified has not been completed, the city shall contact the Contractor to indicate the necessary corrective measures. The Contractor will be given forty-eight (48) hours from this notification to make appropriate corrections. If the work has been completed successfully then the city will pay for services billed.

909. SPECIAL CONDITIONS

1. This location will be newly installed and under warranty by the installer for a twelve (12) month period on plants, trees, and palms. Landscape installer will coordinate irrigation operation with the Maintenance contractor to assure adequate irrigation to the landscape materials. Installer will also be responsible for the untying of palm heads/fronds as they feel appropriate.
2. All listed acreage or square footage figures are estimates.
3. All work shall be performed in a good and workmanlike manner, consistent with trade practices and standards which prevail in the industry.
4. The Contractor shall be responsible for damage to any plant material or site feature caused by the Contractor or their employees. The Contractor shall be notified in writing of the specific nature of the damage and cost of repair. The city shall, at its option, invoice the Contractor for the payment, or reduce by the amount of the repairs on the next regular payment to the Contractor.
5. Occasionally circumstances (standing water, prolonged inclement weather, parked vehicles, etc.) may make all or portions of a location unserviceable during the regular schedule. The Contractor shall notify the city Supervisor of such occurrences and shall schedule to perform the required work to the location as soon as the pertaining circumstances are relieved.

910. TREE PROTECTION

910-1. TREE BARRICADES

A. A protective barrier shall be placed around all protected trees and palms prior to land preparation or construction activities within or adjacent to the work zone, including all staging and/or lay down areas. Protective barriers shall be installed as follows:
   1. At or greater than the full dripline of all species of Mangroves and Cabbage Palms.
   2. At or greater than the full dripline or all protected native pine trees and other conifer species.
   3. At or greater than two-thirds (2/3) of the dripline of all other protected species
   4. At or greater than the full dripline of trees within a specimen tree stand.

B. Protective barriers are to be constructed using no less than two-inch (2”) lumber for upright posts. Upright posts are to be at least four feet (4’) in length with a minimum of one foot (1’) anchored in the ground. Upright posts are to be placed at a maximum distance of eight feet (8’) apart. Horizontal rails are to be constructed using no less than one-inch (1”) by four-inch (4”) lumber and shall be securely attached to the top of the upright post. The city’s Project Manager must approve any variation from the above requirements.

C. Whenever a protective barrier is required, it shall be in place until all construction activity is terminated. The area within the barrier limits shall remain undisturbed by any activity during construction. Native ground cover and understory vegetation existing within the barriers shall remain throughout construction. Exotic plant species may only be removed by manual labor utilizing hand tools or by other means if authorized in writing by the city's Project Manager
D. Prior to the erection of any required protective barrier, all surface foreign material, trash or debris shall be removed from the area enclosed by the barrier, and after erection of the barrier no such material or litter shall be permitted to remain within the protected area. No equipment, chemicals, soil deposits or construction materials shall be placed within such protective barriers.
E. No signs, building permits, wires, or other attachments of any kind shall be attached to any protected tree or palm.
F. At all times, due care shall be taken to protect the critical root zone of trees protected by this section, and root pruning requirements shall apply to such trees.

910-2. ROOT PRUNING

A. Where proposed construction improvements involve excavation and/or impacts to the critical root zone of protected trees, the Contractor shall be required to have an International Society of Arboriculture (ISA) certified arborist perform, or directly supervise root pruning to reduce the impacts of construction. The critical root zone is equivalent to the tree's dripline. Prior to any clearing, grubbing or excavation activities, the affected roots must be severed by clean pruning cuts at the point where grubbing or excavation impacts the root system. Roots can be pruned utilizing specified root pruning equipment designed for that purpose or by hand digging a trench and pruning roots with a pruning saw, chain saw, or other equipment designed for tree pruning. Root pruning by trenching equipment or excavation equipment is strictly prohibited. Roots located in the critical root zone that will be impacted by construction activities shall be pruned to a minimum depth of eighteen inches (18") below existing grade or to the depth of the proposed impact if less than eighteen inches (18") from existing grade. Any questions should be addressed to the city's Project Manager.
B. Root pruning shall only be performed by or under the direct supervision of an International Society of Arboriculture (ISA) certified arborist.
C. Any proposed root pruning trenches shall be identified on site (i.e. staked or painted) inspected and approved by the city's Project Manager and/or Representative prior to actual root pruning.
D. Root pruning shall be performed as far in advance of other construction activities as is feasible, but at a minimum shall be performed prior to ANY impacts to the soil. Associated tree protection measures should be implemented upon completion of said root pruning.
E. If there is a likelihood of excessive wind and/or rain exceptional care shall be taken on any root pruning activities.
F. Root pruning shall be limited to a minimum of ten inches (10") per one inch (1") of the trunk diameter from the tree base. Any exception must be approved by the city's Project Manager prior to said root pruning.
G. Roots shall be cut cleanly, as far from the trunk of the tree as possible. Root pruning shall be done to a minimum depth of eighteen inches (18") from existing grade, or to the depth of the disturbance if less than eighteen inches (18").
H. Root pruning shall be performed using a root cutting machine specifically designed for this purpose. Alternate equipment or techniques must be approved by the city's Project Manager, prior to any work adjacent to trees to be preserved.
I. Root pruning shall be completed, inspected, and accepted prior to the commencement of any excavation or other impacts to the critical root zones of trees to be protected.
J. Excavations in an area where root are present shall not cause the tearing or ripping of tree roots. Roots must first be cleanly severed prior to continuing with the excavation or tunneled around to prevent damage to the root.

K. Tree roots shall not be exposed to drying out. Root ends shall be covered with native soil or burlap and kept moist until final backfill or final grades has been established.
L. When deemed appropriate (e.g., during periods of drought) the city Project Manager may require a temporary irrigation system be utilized in the remaining critical root zones of root pruned trees.
M. When underground utility lines are to be installed within the critical root zone, the root pruning requirement may be waived if the lines are installed via tunneling or directional boring as opposed to open trenching.

910-3. PROPER TREE PRUNING

A. All tree pruning and/or root pruning on existing trees to remain shall only be performed by or under the direct supervision of an International Society of Arboriculture (ISA) certified arborist. Furthermore, all tree work shall conform to the American National Standards Institute (ANSI) 2001, American National Standard for tree care operations – Tree, Shrub, and other Woody Plant Maintenance – Standard practices (pruning) ANSI A-300.
B. Proper pruning techniques for all lateral branches of protected trees are required. Flush cuts (pruning cuts that remove the branch collar) and stub cuts (cuts that leave a stub on the tree) are improper techniques. Any protected tree that has been improperly pruned will not be recognized as a tree left on the project in a healthy growing condition and will require replacement consistent with the current City Code of Ordinances and Community Development Code.
C. No protected tree shall have more than thirty percent (30%) of its foliage removed.
D. No protected tree shall be topped, hat racked, or lion tailed. Any protected tree that has been improperly pruned will not be recognized as a tree left on the project in a healthy growing condition and will require replacement consistent with the current City Code of Ordinances and Community Development Code.
E. Tree Trunks and limbs shall be protected. The use of tree spikes or other devices that damage trunk and bark tissue on protected trees shall be prohibited. Any protected tree that has been damaged in such a manner will not be recognized as a tree left on the project in a healthy growing condition and will require replacement consistent with the current City Code of Ordinances and Community Development Code.

911. IRRIGATION SYSTEM DESIGN

The requirements for Irrigation System Design are the following:

A. The application rate must not exceed the ability of the soil to absorb and retain the water applied during any one application.
B. The design operating pressure must not be greater than the available source pressure.
C. The design operating pressure must account for peak use times and supply line pressures at final buildout for the entire system.
D. Distribution devices and pipes should be designed for optimum uniform coverage. The first and last distribution device should have no more than a 10% difference in flow rate. This usually corresponds to about a 20% difference in pressure.
E. “Head to head” placement of sprinklers to achieve 100% coverage.
F. Flexibility must exist to meet a site’s peak water requirements and allow for the modification of the system’s operation to meet seasonal irrigation changes or local restrictions.
G. Distribution equipment (such as pop-ups, rotors, bubblers and drip) in a given zone must have the same precipitation rate.
H. Turf and landscape areas should be zoned separately based on plant water requirements. Bubblers, drip, rotors and pop-ups will all be on separate zones.
I. All water delivery devices (heads, tree bubblers, valves) shall be free of buried obstructions 8-10” below each device to be acceptable.

J. Install valves in Turf areas where possible
K. Install all irrigation heads at finish grade unless approved by Parks and Rec. **before installation.**
L. The design package should include a general irrigation schedule with recommendations and instructions on modifying the schedule for local climatic and growing conditions.
M. If required by plant species, the design should account for the need to leach out salt buildup from poor quality water.
N. Water supply systems (such as wells and pipelines) should be designed for varying control devices, and backflow prevention.
O. Water conveyance systems should be designed with thrust blocks and air release valves, such that **flow velocity is 5 feet per second or less**.
P. Pipelines should be designed to provide the system with the appropriate pressure required for maximum irrigation uniformity.
Q. Pressure regulating or compensating equipment must be used where the system pressure exceeds the manufacturer's recommendations.
R. Equipment with check valves must be used in low areas to prevent low head drainage.
S. A rain-sensing device must be used to automatically shut off system when raining.
T. Non-planted areas, including impervious surfaces should not be irrigated.
U. The city of Clearwater, Parks and Beautification must approve irrigation plan before irrigation construction begins.

912. IRRIGATION SYSTEM INSTALLATION

The requirements for Irrigation System Installation are the following:

A. Only qualified specialists under the direct supervision of a "Certified Irrigation Designer" or a "Certified Irrigation Contractor" should install the irrigation system. Certifications are through "The Irrigation Association".
B. The construction must be consistent with the design.
C. The designer must approve any design changes before construction.
D. Construction and materials should meet existing standards and criteria.
E. **Mainline** – To be laid with tracking wire / tape firmly attached throughout project. Leave 18" of excess cable at terminal ends in 6" round valve boxes. See Parks and Rec Irrigation Spec page for type.
F. Sleeve size will be 2 times the diameter of pipe to be sleeved. Example 1.5" feed pipe dia. = 3" sleeve diameter.
G. Acceptable safety practices must be followed during construction.
H. All underground cables, pipes and other obstacles should be identified, and their locations flagged.
I. Obtain all permits before construction.
J. Always give the city Engineering and Parks & Recreation Department a copy of the As-Built plans, operating manuals, warranties, and written instructions on how to change the irrigation system's timers/clock/controllers.
K. At the end of construction, the site must be cleaned of all construction materials.

EAST WATER RECLAMATION FACILITY
SCREW PUMP REPLACEMENT

TECHNICAL SPECIFICATIONS

Project No. 03720-062-01

Owner:

CITY OF CLEARWATER
100 S. Myrtle Avenue
Clearwater, Florida 33756

Engineer:

JONES EDMUNDS & ASSOCIATES, INC.
324 S. Hyde Park Avenue, Suite 250
Tampa, Florida 33606

October 2023

CITY OF CLEARWATER
EAST WATER RECLAMATION FACILITY
SCREW PUMP REPLACEMENT
TECHNICAL SPECIFICATIONS

Sean P. Menard, PE, Florida Professional Engineer No. PE88647
This item has been digitally signed and sealed by Sean P. Menard, PE, on the date indicated here. Printed copies of this document are not considered signed and sealed. The signature must be verified on any electronic copies. The above-named Professional Engineer shall be responsible for the following Divisions in accordance with Rule 61G15-23.004, FAC:
Divisions 1, 2, 9, 11, and 15
Jones Edmunds & Associates, Inc.

John V. Sobczak, PE, Florida Professional Engineer No. PE71407
This item has been digitally signed and sealed by John V. Sobczak, PE, on the date indicated here. Printed copies of this document are not considered signed and sealed. The signature must be verified on any electronic copies. The above-named Professional Engineer shall be responsible for the following Divisions in accordance with Rule 61G15-23.004, FAC:
Division 3
Wekiva Engineering, LLC

CITY OF CLEARWATER
EAST WATER RECLAMATION FACILITY
SCREW PUMP REPLACEMENT
TECHNICAL SPECIFICATIONS

Willard C. Hoanshelt, PE, Florida Professional Engineer No. PE42593

ENGINEER-PROVIDED TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

DIVISION 1—GENERAL REQUIREMENTS

01000 PROJECT REQUIREMENTS
01100 SUMMARY OF WORK
01200 MEASUREMENT AND PAYMENT
01290 SCHEDULE OF VALUES
01310 CONSTRUCTION COORDINATION
01320 PROGRESS SCHEDULE
01325 CONSTRUCTION PHOTOGRAPHS
01330 SUBMITTALS AND ACCEPTANCE
01350 ENVIRONMENTAL PROTECTION PROCEDURES
01355 SPECIAL PROVISIONS
01450 TESTING AND TESTING LABORATORY SERVICES
01500 TEMPORARY FACILITIES AND CONTROLS
01600 MATERIALS AND EQUIPMENT
01650 DELIVERY, STORAGE, AND HANDLING
01730 CUTTING, CORING, AND PATCHING
01740 FINAL CLEANING
01755 EQUIPMENT TESTING AND STARTUP
01770 PROJECT CLOSEOUT
01780 WARRANTIES AND BONDS
01815 MAINTENANCE OF PLANT OPERATION AND SEQUENCE OF CONSTRUCTION
01820 TRAINING
01830 OPERATIONS AND MAINTENANCE MANUALS

DIVISION 2—SITE CONSTRUCTION

02220 DEMOLITION AND MODIFICATIONS
02370 EROSION AND SEDIMENTATION CONTROL

DIVISION 3—CONCRETE

03600 GROUT

DIVISION 9—FINISHES

09900 PAINTING AND COATING

DIVISION 11—EQUIPMENT

11000 GENERAL EQUIPMENT REQUIREMENTS
11282 FABRICATED GATES
11310 OPEN SCREW PUMP EQUIPMENT

DIVISION 15—MECHANICAL

15075 PROCESS EQUIPMENT, PIPING, AND VALVE IDENTIFICATION

DIVISION 16—ELECTRICAL

16050 ELECTRICAL – GENERAL PROVISIONS
16075 ELECTRICAL IDENTIFICATION
16110 RACEWAYS AND FITTINGS
16120 WIRES AND CABLES
16130 BOXES
16140 WIRING DEVICES
16170 SAFETY SWITCHES
16450 GROUNDING SYSTEM
16900 SCREW PUMP LIFT STATION CONTROL PANEL

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01000
PROJECT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work to be done consists of the furnishing of all labor, materials, and equipment and the performance of all Work included in this Contract. The summary of the Work is presented in Section 01100, Summary of Work.

B. Work Included

1. The Contractor shall furnish all labor, superintendence, materials, plant power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the Work. The Contractor shall obtain and pay for all necessary local building permits. The Contractor shall perform and complete the Work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer and in strict accordance with the Contract Documents. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all Work and pay all costs incidental thereto. The Contractor shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.
2. The cost of incidental work described in these Project Requirements for which there are no specific Contract Items shall be considered as part of the general cost of doing the Work and shall be included in the prices for the various Contract Items. No additional payment will be made therefor.
3. The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the Work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship, materials, and equipment, prior approval of the Owner notwithstanding.

C. Public Utility Installations and Structures

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, vaults, manholes, and all other appurtenances and facilities pertaining thereto whether owned or controlled by the Owner, other governmental bodies, or privately owned

by individuals, firms, or corporations used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.

a. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition, and extent of all such installations and structures as may be encountered and as may affect the construction operations.

b. The Contractor shall protect all public utility installations and structures from damage during the Work. Access across any buried public utility installation or structure shall be made to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor shall be repaired by the Contractor, at his expense. No separate payment shall be made for such protection or repairs to public utility installations or structures.

c. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced, or rebuilt by the Contractor shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various Contract Items. No separate payment shall be made therefor.

d. Where public utility installations of structures owned or controlled by the Owner or other governmental body are encountered during the Work and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement, or rebuilding is necessary to complete the Work under this Contract, such Work shall be accomplished by the utility having jurisdiction, or such Work may be ordered, in writing by the Owner, for the Contractor to accomplish. If such work is accomplished by the utility having jurisdiction it will be carried out expeditiously, and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement, or rebuilding as required. If such work is accomplished by the Contractor, it will be paid for as extra work as provided in the Agreement.

e. At all times in performance of the Work the Contractor shall employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of

public utility installations and structures and shall at all times in the performance of the Work avoid unnecessary interference with or interruption of public utility services and cooperate fully with the owners thereof to that end.

f. The Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations at least 48 hours in advance of breaking ground in any area or on any unit of the Work.

g. The maintenance, repair, removal, relocation, or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the owners of such utilities.

1.02 DRAWINGS AND PROJECT MANUAL

A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions and large-scale drawings in preference to small-scale drawings.

B. Supplementary Drawings

1. When, in the opinion of the Engineer, it becomes necessary to explain more fully the Work to be done or to illustrate the Work further or to show any changes that may be required, the Engineer will prepare drawings known as Supplementary Drawings, with specifications pertaining to such Drawings, and the Contractor will be furnished one complete set of reproducible black-line prints (22 inches by 34 inches) and one reproducible copy of the specifications, or alternatively may be provided electronic files in PDF format, at the Contractor’s option.
2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefor to the Contractor shall be subject to the terms of the Agreement.

C. Contractor to Check Drawings and Data

1. The Contractor shall verify all dimensions, quantities, and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications, or other data received from the Owner, and shall notify the Engineer of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty

construction, or improper operation resulting therefrom, nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Owner should such errors or omissions be discovered.

2. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for making estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under the Contract.

D. Specifications: The Technical Specifications each consist of three parts: General, Products, and Execution. The General part of a Specification contains General Requirements that govern the Work. The Products and Execution parts modify and supplement the General Requirements by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.

E. Intent

1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications but involved in carrying out their intent or in the complete and proper execution of the Work is required and shall be performed by the Contractor as though it were specifically delineated or described.
2. The apparent silence of the Specifications as to any detail or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used. The interpretation of these Specifications shall be made upon that basis.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer

1. All transactions with the manufacturers or subcontractors shall be through the Contractor unless the Contractor shall request and at the Engineer's option that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
2. Any two or more pieces of material or equipment of the same kind, type, or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery

1. The Contractor shall deliver materials in ample quantities to ensure the most speedy and uninterrupted progress of the Work to complete the Work within the allotted time.
2. The Contractor shall also coordinate deliveries to avoid delay in or impediment of the progress of the work of any related Contractor.

C. Tools and Accessories

1. Unless otherwise stated in the Contract Documents, the Contractor shall furnish each type, kind, or size of equipment one complete set of suitably marked high-grade special tools and appliances that may be needed to adjust, operate, maintain, or repair the equipment. Such tools and appliances shall be furnished in approved painted-steel cases, properly labeled, and equipped with good-grade cylinder locks and duplicate keys.
2. Spare parts shall be furnished as specified herein and as recommended by the manufacturer necessary for the operation of the equipment, not including materials required for routine maintenance.
3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place, and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight, and principal rate data.

D. Service of Manufacturer's Engineer

1. The Contract Prices for equipment shall include the cost of furnishing a competent and experienced engineer or superintendent who shall represent the manufacturer and shall help the Contractor, when required, install, adjust, test, and place in operation the equipment in conformity with the Contract Documents.
2. After the equipment is placed in permanent operation by the Contractor, the engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that the equipment is in proper and satisfactory operating condition and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General

1. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests, and the reports thereof

shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Electronic copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

2. If, in the making of any test of any material or equipment, the Engineer ascertains that the material or equipment does not comply with the Contract Documents, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material without cost to the Owner.
3. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with the recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
4. The Contractor shall be fully responsible for the proper operation of equipment during testing and instruction periods and shall neither have nor make any claim for damage that may occur to the equipment before the time when the Owner formally takes over the operation thereof.

B. Costs

1. The Contractor shall provide all inspection and testing of materials furnished under this Contract, unless otherwise expressly specified.
2. The Contractor shall bear the cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents, and such costs shall be deemed to be included in the Contract Price.
3. The Owner may test materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests of materials and equipment that are rejected for non-compliance.

C. Certificate of Manufacture

1. The Contractor shall furnish the Engineer with authoritative evidence in the form of a certificate of manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.
2. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

D. Shop Tests

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements are specified shall be tested in the shop of the maker in a manner that shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents.
2. Electronic copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company and/or independent laboratory, shall be submitted to the Engineer for approval.
3. The Contractor shall bear the cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment.

E. Start-up Tests

1. As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make start-up tests of equipment.
2. If the start-up tests disclose any equipment furnished under this Contract that does not comply with the requirements of the Contract Documents, the Contractor shall, before demonstration tests, make all changes, adjustments, and replacements required. The furnishing Contractor shall assist in the start-up tests as applicable.

F. Demonstration Tests

1. Before the Contractor's request for a Substantial Completion inspection, all equipment and piping installed under this Contract shall be subjected to demonstration tests as specified or required to prove compliance with the Contract Documents.
2. The Contractor shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all demonstration tests at no additional cost to the Owner. The Contractor shall assist in the demonstration tests as applicable.

1.05 LINES AND GRADES

A. Grade

1. All Work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

2. The Engineer will establish benchmarks and coordination points. Reference marks for lines and grades as the Work progresses will be located by the Contractor to cause as little inconvenience to the prosecution of the Work as possible. The Contractor shall place excavation and other materials so as to cause no inconvenience in the use of the reference marks provided. He shall remove any obstructions he places contrary to this provision.

B. Surveys

1. At his own expense, the Contractor shall furnish and maintain stakes and other such materials.
2. The Contractor shall check such reference marks by such means as he may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies.
3. At his own expense, the Contractor shall establish all working or construction lines and grades as required from the reference marks set by the Engineer and shall be solely responsible for the accuracy of these lines and grades. He shall, however, be subject to check and review by the Engineer.

C. Safeguarding Marks

1. The Contractor shall safeguard all points, stakes, grade marks, monuments, and benchmarks made or established on the Work; bear the cost of re-establishing them if disturbed; and bear the entire expense of rectifying Work improperly installed due to not maintaining or protecting or removing without authorization such established points, stakes, and marks.
2. The Contractor shall safeguard all existing and known property corners, monuments, and marks adjacent to but not related to the Work and shall bear the cost of re-establishing them if they are disturbed or destroyed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01100
SUMMARY OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

Unless otherwise expressly provided in the Contract Documents, the Work must be performed in accordance with best modern practice, with materials and workmanship of the highest quality to the satisfaction of the Owner.

A. The Project title is **East Water Reclamation Facility Screw Pump Replacement**.

B. The Specification divisions and Drawings are an integrated part of the Contract Documents and, as such, will not stand alone if used independently as individual sections, divisions, or drawing sheets. The Drawings and Specifications establish minimum scope of work and standards of quality for this project. They do not purport to cover all details entering into the design and construction of materials and equipment.

1.02 PROJECT DESCRIPTION

The work for this project generally includes but is not limited to the following:

A. Base Bids items generally including the following:

1. Replace three existing open screw pumps, grease pumps, motors, and appurtenances as required by the Contract Documents.
2. Refurbish the existing three slide gates located adjacent to the existing screw pumps as required by the Contract Documents.
3. Modify the existing electrical system including new electrical conduit, wire, starter panels; modify the existing motor control center; reconnect proposed signal wiring to the existing control panel and supervisory control and data acquisition (SCADA) system to match the existing; and other improvements to the screw pumps as required by the Contract Documents.
4. Provide coating systems as indicated in the Contract Documents and expansion joint and crack injection repair on the screw pump concrete structure.
5. Any other items indicated within the Contract Documents.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Association of State Highway and Transportation Officials (AASHTO) Formerly (AASHO)
B. American Concrete Institute (ACI)
C. American Institute of Steel Construction (AISC)
D. American Iron and Steel Institute (AISI)
E. American National Standards Institute (ANSI)
F. American Standards Association (ASA)
G. American Society of Mechanical Engineers (ASME)
H. American Society of Testing and Material (ASTM)
I. American Water Works Association (AWWA)
J. American Welding Society (AWS)
K. Anti-Friction Bearing Manufacturer's Association (AFBMA)
L. Building Officials and Code Administrators International, Inc. (BOCA)
M. Construction Specifications Institute (CSI)
N. Federal Specification (FS)
O. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, Latest English Edition (Standard Specifications)
P. FDOT Roadway and Traffic Design Standards Latest English Edition (FDOT Index)
Q. Geosynthetics Institute (GSI)
R. National Bureau of Standards (NBS)
S. National Electrical Manufacturer's Association (NEMA)
T. National Fire Protection Association (NFPA)
U. Portland Cement Association (PCA)
V. Occupational Safety and Health Act (Public Law 91-596), U.S. Department of Labor (OSHA)
W. Steel Structures Painting Council (SSPC)
X. Southern Standard Building Code (SSBC)
Y. Underwriters' Laboratories, Inc. (UL)
Z. United States of America Standards Institute (USASI)
AA. Regulations of Florida Industrial Commission Regarding Safety
BB. All local, state, county, or municipal building codes requirements of the Owner's Insurance

1.04 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.06 WORKING HOURS

A. Work under this contract shall not be prosecuted on Saturdays, Sundays, or on State and/or National holidays, except in time of emergency, and then only under written permission from the Owner who shall be the sole judge as to the urgency of that situation. On weekdays, the workday shall be limited to daylight hours and in accordance with Community Development Code.

B. If the Contractor deems it necessary to work on Saturdays, Sundays, holidays, or beyond daylight hours to comply with his construction schedule or because of an emergency, the Contractor shall request permission of the Owner to do so. If, in the opinion of the Owner, the need is bona fide, the Owner will authorize the Contractor to work such hours as may be necessary. The Contractor shall adhere to noise restrictions from 6:00 p.m. to 7:00 a.m. any day and all day Sunday according to the Community Development Code, Section 3-1508.

1.07 REIMBURSEMENT FEES

A. The Contractor shall reimburse the Owner for the charges of the Engineer and Engineer’s Consultants as a result of the following actions:

1. Services due to Contractor's working beyond regular working hours as defined in the General Requirements.
2. Evaluation of substitutions.
3. Costs generated as a result of more than two submittals of any one Shop Drawing or Sample being required for evaluation due to rejection for noncompliance of the original submittal or for lack of information required by the Contract Documents.
4. Additional field observations, engineering analysis, correspondence, meetings, or other work due to non-complying or defective construction, materials, or equipment performed or furnished by the Contractor, Subcontractors, or Suppliers.
5. All costs due to work not being ready for tests and/or inspections when the Contractor has notified Engineer that work is ready for tests and/or inspections. The Contractor shall reimburse the Owner for all failed tests and subsequent retests. Partial payments payable to Contractor shall be

distributed, first to reimburse the Owner for such charges, with the balance distributed to the Contractor in accordance with the Contract Documents.

B. The Owner's reimbursement for the charges shall be a deduction from the Contractor's partial payment(s).

C. The following rates shall be applied as the Owner's reimbursement of the Engineer's fee to be paid by the Contractor for expenses defined above.

1.	Senior Field Representative (Construction):	$ 90.00/hour
2.	Senior Construction Administrator:	$100.00/hour
3.	Engineering Consultant (Senior Project Manager):	$170.00/hour
4.	Administrative Assistant:	$ 60.00/hour

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers methods of measurement and payment for items of work under this Contract.

B. The total Contract Price shall cover all work required by the Contract Documents. All cost in connection with the proper and successful completion of the work including furnishing all materials, equipment, and tools and performing all necessary labor and supervision to fully complete the work, shall be included in the unit price and lump-sum Bid prices. All work not specifically set forth as a pay item in the Bid Form or Bid Schedule shall be considered a subsidiary/ ancillary obligation of the Contractor and all costs in connection with these subsidiary/ancillary obligations shall be included in the Bid(s) to provide a complete and functional Project.

1.02 EXCAVATION, TRENCHING, AND CLEARING

A. Except where otherwise specified, the unit price or lump-sum price bid for each item of work which involves excavation, trenching, clearing, grubbing, or disposal of cleared and grubbed materials shall include all costs for such work. No direct payment shall be made for clearing, grubbing, disposal of cleared or grubbed materials, excavation, trenching, disposal of surplus excavated material, handling water (and groundwater), and purchasing and hauling of required fill material. All excavation and trenching shall be unclassified as to materials which may be encountered; in addition, trenches shall be unclassified as to depth, unless otherwise stated.

1.03 LUMP SUM

A. For lump-sum items, payments shall be made to the Contractor in accordance with an accepted Progress Schedule of Values on the basis of actual work completed and accepted by the Owner at the final completion of the Project.

1.04 UNIT PRICE

A. For unit price items, payment shall be made based on the actual amount of work accepted by the Owner and for the actual amount of materials in place at the final completion of the Project, as confirmed by the final measurements.

B. After the work is completed and before final payment is made, the Engineer will make final measurements, with all required assistance from the Contractor, to determine the quantities of various items of work accepted as the basis for the final unit price payment.

1.05 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

A. When alterations in the quantities of unit price work not requiring a Change Order(s), as herein provided for, are ordered and performed, the Contractor shall accept payment in full at the Contract unit price multiplied by the actual quantities of work constructed and accepted by the Owner at the completion of the project.

B. The actual percentage of each lump-sum bid item completed by the Contractor and accepted by the Owner at the final completion of the Project will be paid to the Contractor.

1.06 DELETED ITEMS

A. Should any items contained in the Bid Schedule(s) be found unnecessary for the proper completion of the work contracted, the Engineer may eliminate such items from the Contract. This action shall in no way invalidate the Contract and no financial allowance or compensating payment for anticipated profit, overhead, etc., will be made for items so eliminated in making final payment to the Contractor.

1.07 PARTIAL PAYMENTS

A. Partial payments will be made monthly as the work progresses. Partial payment will be made subject to the provisions of the General and Supplementary Conditions.

1.08 PAYMENT FOR STORED MATERIAL DELIVERED TO THE PROJECT

A. When requested by the Contractor and at the discretion of the Owner, payment may be made for all or part of the value of acceptable materials and equipment to be incorporated into bid items, which have not been used, and which have been delivered to the construction site or placed in storage places acceptable to the Owner. The Contractor shall provide receipts for all stored material items requested for reimbursement which clearly identify the stored material item, where it is to be constructed, the unit cost of the item, as well as the total cost of the delivered item(s), the quantity of the item, the brand name of the item, and the supplier. Note that there are additional documentation requirements and storage

requirements within the Contract Documents that must also be met before the Contractor can be reimbursed for these stored materials.

B. No payment shall be made for fuels, supplies, installation or connection hardware, lumber, false work, or other similar materials or on temporary structures or other work (items) of any kind which are not a permanent part of the Contract. Items having a value of less than $2,500 shall not be compensated for as a stored material item.

1.09 FINAL PAYMENT

A. If requested by the Engineer, the Contractor shall field verify all quantities in dispute by using visual observation, taped measurements, or other methods designated by the Engineer. The field verification shall be made in the presence of the Engineer and agreed to by both the Engineer and the Contractor. The Engineer will prepare a final adjusting Change Order that will adjust the final quantities of the project Bid Schedule to reflect the actual work accepted by the Owner and for which the Contractor will be compensated.

1.10 SCHEDULE OF VALUES

A. A schedule of values for the lump-sum bid items and some of the unit-price bid items as required by the Engineer shall be submitted and accepted before the first pay request is approved by the Engineer. The schedule of values shall be based on the prices bid in the Bid Schedule(s). Prices bid in the Bid Schedule(s) cannot be changed in the schedule of values; they can only be broken down into more detail so that the Engineer can more accurately review and approve the Contractor's pay application for the completed work.

1.11 MISCELLANEOUS CONSTRUCTION ITEMS

A. When pipe/service lines are constructed across a road, the road shall not be cut to perform this construction unless authorized in writing by the Engineer. Service lines are to be bored, jack and bored, or horizontally directionally drilled (HDD) under the road. Jetting of water lines or water service lines will not be allowed.

B. The Contractor shall take all precautions necessary to protect existing utilities, roads, and miscellaneous items from damage during construction.

C. The Contractor shall repair, relocate, or replace existing utilities, roadways, and miscellaneous items to pre-construction conditions.

D. All repairs, relocations, and replacements necessary are considered incidental to the work and will be at the Contractor's cost, with no cost to the Owner.

PART 2 PAY ITEM DESCRIPTIONS

2.01 BID

The descriptions provided in the following Paragraphs are to be used by the Bidder in preparing the Bid Schedule(s). They generally indicate how the major workscope items and their respective costs are to be separated into the line items listed in the Bid Schedule(s). These descriptions are not fully representative nor all-inclusive of the work required to complete the project in accordance with the Contract Documents. It is the Bidder's responsibility to include all required costs within the most appropriate line item(s).

2.02 BASE BID

Item 1. Mobilization/Demobilization and General Conditions (not to exceed 8% of the Base Bid)—This lump-sum item shall include and cover the costs for performing construction, preparatory, and overhead operations, including but not limited to moving personnel and equipment to and from the site; providing sanitary facilities and temporary utilities; providing project administration and management, insurance, bonds, and Owner and Engineer indemnification; and all other similar activities and facilities necessary for executing this project. This item shall not exceed 8% of the Base Bid amount. The Contractor will be paid 20% of this item upon completion of mobilization and 10% upon demobilization; the remainder will be prorated equally over the construction period.

Item 2. Screw Lift Station Upgrades—The Contractor shall furnish all labor, materials, equipment, and services for the improvements to the screw lift station at the East Water Reclamation Facility in accordance with the Contract Documents including but not limited to:

- Unload, move, and adjust the screw pumps.
- Install all coffer dams, pump-down equipment, piping, and valves.
- Remove three existing screw pumps and all associated supports, lubrication systems, and appurtenances.
- Demolish existing grease pumps and local safety switches for the three screw pumps.
- Load, transport, and dispose of demolished materials in an approved disposal facility in accordance with applicable federal, state, and local regulations and in accordance with the Contract Documents.
- Provide interior coating system, expansion joint, and crack injection repairs to the concrete structure for the screw pumps.
- Furnish and install three screw pumps, all associated supports, lubrication systems, and appurtenances. The Bid item is to include any anchor bolts, equipment, components, etc., that are not specifically included but are necessary to place the replacement screw pump into service.

- Install new electrical conduit, wire, starter panels, and related components and modify the existing motor control center associated with the three new screw pumps.
- Reconnect the proposed signal wiring to the existing control panel and supervisory control and data acquisition (SCADA) system to match existing.
- Include the costs for all other work, material, equipment, and items not included in other Bid items.
- Perform testing and startup.

All work shall be performed in accordance with the Contract Documents. Payment for this item will be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon Engineer verification.

Item 3. Refurbishment of Slide Gates—This item includes refurbishing the existing three slide gates. The Contractor shall be responsible for coordinating the refurbishment requirements with the slide gate manufacturer including but not limited to removing, shipping, repairing, and replacing. Payment for this item will be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon Engineer verification.

Item 4. Owner's Contingency—The Contractor shall furnish all labor, materials, equipment, and services to perform unforeseen work not included in the other Bid items that may be requested and approved by the Engineer and Owner. The scope of work and cost of this additional work shall be agreed on in writing and approved by the Engineer and Owner before the work begins. The Contractor will be paid based on the agreed-on schedule of values for the approved work.

2.03 DEDUCTIVE BID ALTERNATE

The Bidder shall submit its Bid on the basis of the Base Bid and shall provide separate negative Bid prices for the relative cost reduction for each deductive alternate, if any, described in the Bid Documents and as provided for on the Bid Form.

For determining the apparent low Bidder, Bids will be compared on the basis of the aggregate amount of the Base Bid, plus any combination of the deductive alternates as determined by the Owner.

Item A. Slide Gate Replacement—The cost for the lump-sum deductive bid alternate item in the Bid Form shall include full compensation for furnishing all labor, materials, equipment, and services related to replacing the three slide gates in kind with new slide gates in lieu of refurbishing the three gates as required in the Base Bid. This work shall include but not be limited to the gates, appurtenances, and structural modifications required to replace and secure the gates, warranties, testing, etc. If the Owner elects to include this optional deductive bid alternate, the relative cost reduction shall be applied to Bid Item 3, and payment for this item will

be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon the Engineer's verification.

Item B. Individual Bypass—The cost for the lump-sum deductive bid alternate item in the Bid Form shall include full compensation for furnishing all equipment and services related to an alternate bypass plan used to bypass and/or isolate individual screw pumps for replacement in lieu of the bypassing the entire screw pump station as required in the Base Bid. This work shall include but not be limited to any isolation materials (coffer dam, inflatable devices, etc.), bypass pumps (if required), accessories, etc. The approval of this deductive bid alternate shall depend on Owner and Engineer approval of a formally submitted alternate bypass plan that shall be required to be submitted alongside the Bid. If the Owner elects to include this optional deductive bid alternate, the relative cost reduction shall be applied to Bid Item 2, and payment for this item will be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon the Engineer's verification.

Item C. Omitting Concrete Repair of Effluent Channel—The cost for the lump-sum deductive bid alternate item in the Bid Form shall include full reduction of cost for furnishing all equipment and services related to the concrete repair of the effluent channel as indicated in the Contract Documents. This reduction of work shall include reduced bypass, coating, inspection, crack repair, and any other efforts as indicated in the Contract Documents to complete the repair of the effluent channel. If the Owner elects to include this optional deductive bid alternate, the relative cost reduction shall be applied to Bid Item 2, and payment for this item will be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon the Engineer's verification.

END OF SECTION

SECTION 01290
SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. To the Engineer, a proposed Schedule of Values allocated to the various portions of the Work, in accordance with Section 01000, Project Requirements, and Section 01200, Measurement and Payment.

B. Upon request of the Engineer, supporting data that will substantiate the values' correctness.

C. The accepted Schedule of Values shall be used as the basis for the Contractor's Applications for Payment.

D. An update and resubmittal of the Schedule of Values when Change Orders affect the listing or when the actual performance of the Work involves necessary changes of substance to values previously listed and approved.

E. Schedule of Values

1. Submit typed schedule on EJCDC 1910-8-E forms or another format as may be approved by the Engineer.
2. Submit Schedule of Values in PDF format via Owner-approved electronic transmittal method or on CD, or as duplicate hardcopies, within 10 days after the date of Owner-Contractor Agreement.
3. Format – Use the schedule of prices in the Bid Proposal. Show the cost breakdown for each lump-sum item. The lump-sum breakdown shall, at a minimum, use the Table of Contents of this manual outline. Identify each line item with the number and title of the major Specification Section. Identify site mobilization and demobilization, bonds and insurance, Record Drawings, photographs, and operations and maintenance manuals, etc.
4. For unit cost allowances, identify quantities taken from the Contract Documents multiplied by the unit cost to achieve the total for the item.

5. Include within each line item a direct proportional amount of the Contractor's overhead and profit.
6. Revise the schedule to list approved Change Orders with each Application for Payment.

1.02 CASH ALLOWANCES (IF USED)

A. Costs Included in Allowances—The cost of the product to the Contractor or subcontractor, less applicable trade discounts and applicable taxes.

B. Costs Not Included in the Allowance, But Included in the Contract Price—Product handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing.

C. Contractor Responsibilities

1. Execute purchase agreement with designated supplier.
2. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
3. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

D. Differences between allowance amounts and actual costs will be adjusted by Change Order before final payment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01310
CONSTRUCTION COORDINATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall coordinate Work with that of other construction projects as needed.

B. Before starting Work and from time to time as the Work progresses, the Contractor and each subcontractor shall examine the work and materials installed by others as it applies to its own work and shall notify the Engineer immediately in writing if any conditions exist which will prevent satisfactory results in the installation of the system. Should the Contractor or subcontractor start work without such notification, it shall be construed as an acceptance of all claims or questions as to the suitability of the work of others to receive its Work. The Contractor shall remove and/or replace, at its own expense, all work under this Contract that may have to be removed on account of such defects or omissions.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. The Contractor shall ensure that all drawing, product data, and samples comply with Contract Documents and field dimensions and clearances.

B. The Contractor shall submit requests for interpretation of Contract Documents in a timely fashion to ensure there are no disruptions with the Work as scheduled. Obtain instructions through the Engineer to resolve all queries.

C. Process requests for substitutions and Change Orders through the Engineer.

D. Deliver close-out submittals to the Engineer.

1.03 WORK SEQUENCE

A. The Contractor shall submit a preliminary Progress Schedule, in accordance with Section 01320, Progress Schedule, to the Engineer. After review, the Contractor shall revise and resubmit the Progress Schedule to comply with requested revisions.

1.04 CONSTRUCTION MOBILIZATION

The Contractor shall do the following:

A. Cooperate with the Owner in allocating mobilization areas on site for field offices and sheds, access, traffic, and parking facilities. During construction, the Contractor shall coordinate the use of the site and facilities through the Engineer.

B. Comply with the Engineer's procedures for intra-project communications: submittals, reports and records, schedules, coordination drawings, recommendations, and resolution of ambiguities/conflicts.

C. Comply with the Engineer’s instructions for use of temporary utilities and construction facilities.

D. Coordinate field engineering and layout work under instructions of the Engineer.

E. Coordinate scheduling, submittals, and work of the various sections of Contract Documents to ensure the efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

F. Coordinate the sequence of Work to accommodate the Owner occupancy as specified in the Contract Documents.

G. In addition to Progress Meetings specified in Section 01320, Progress Schedule, hold pre-construction conferences with personnel and Subcontractors to ensure coordination of Work. The Engineer shall be informed of such meetings and shall be allowed to attend.

H. Coordinate the Work of various sections having interdependent responsibilities for installing equipment, connecting equipment, and placing such equipment in service.

I. Coordinate the use of project space and the sequence of installing civil, architectural, mechanical, structural, instrumentation, systems, and electrical work. Follow practicable routings for pipes, ducts, and conduits, with due allowance for available physical space; make runs parallel with lines of building. Use space efficiently to maximize accessibility for other installations, maintenance, and repairs.

J. Coordinate Work at existing facilities to minimize disruption of the Owner’s operations.

K. Assemble and coordinate close-out submittals specified in Section 01770, Project Closeout.

1.05 COORDINATION DRAWINGS

A. The Contractor shall provide information required by the Engineer for preparing coordination drawings.

B. The Contractor shall review drawings before submitting them to the Engineer.

1.06 CLOSE-OUT PROCEDURES

The Contractor shall do the following:

A. Notify the Owner when Work is considered ready for Substantial Completion.

B. Comply with the Owner's instructions to correct items of Work listed in executed Certificates of Substantial Completion.

C. Notify the Owner when Work has reached Final Completion.

D. Comply with the Owner's instructions for completing items of Work found incomplete in the Engineer's final inspection.

E. Comply with Section 01770, Project Closeout.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. All vehicles on the property or easement must be operational.

3.02 UTILITIES

A. The Contractor shall coordinate the activities of all utility companies with equipment in the construction area with the Contractor’s and Subcontractor’s Work.

3.03 CUTTING AND PATCHING

A. No cutting and patching of new Work will be accepted. All Work must be new and continuous in its final form.

END OF SECTION

SECTION 01320
PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. All work of this Contract shall be scheduled and monitored by the Contractor using the Critical Path Method (CPM) and shall use the Precedence Diagram Method (PDM) of scheduling. The Contractor shall prepare all schedules and all monthly updates described in this Section. The Contractor will prepare revisions of the schedule to reflect changes in the Contractor's plan of performance or changes in the Work and submit these revisions to the Engineer for acceptance. The Engineer's acceptance of the scheduling documents is to ensure that all CPM Scheduling documents prepared by the Contractor are in conformance with the Contract Documents and Specifications described herein. This acceptance will not impose on the Engineer or Owner the responsibility for the schedule or for the sequencing, scheduling, or progress of the Work, nor will the acceptance interfere with or relieve the Contractor of full responsibility for the schedule and the means, methods, procedures, and sequence of construction.

B. The Contractor shall use the latest version of Primavera Scheduling software, or an approved equal, for all CPM Scheduling applications.

C. The Engineer or Owner may retain the professional services of a CPM Scheduling Consultant to assist in the review and acceptance of the CPM Scheduling documents prepared by the Contractor. Therefore, any reference to the Engineer or Owner within this Section may also indicate the involvement of the Engineer's or Owner's CPM Scheduling Consultant.

D. The Contractor shall prepare and maintain a detailed progress schedule throughout the construction of the Project. The schedule shall be the Contractor's working schedule and be used to plan, organize, and execute the Work, record and report actual performance and progress, and show how the Contractor plans to complete the Work. The schedule will be in the form of an activity-oriented network diagram (CPM).

E. When the Contractor prepares the CPM Schedule and the schedule is accepted by the Engineer, it shall become part of the Contract Documents and will be used by Contractor and Engineer to monitor the progress of the Project. The CPM Schedule may be revised to show changes in the Contractor's method or manner of performance or delays or authorized changes in the Work. All changes to the schedule will be made in accordance with Article 1.08 of this Section.

F. The Contractor acknowledges that free float belongs to the Owner.

1.02 PRELIMINARY 90-DAY CPM SCHEDULE

A. The Contractor shall develop and submit a 90-Day CPM Schedule at the pre-construction meeting as specified in Section IV, Article 209, of the City's Technical Specifications . This schedule shall be a computerized CPM Schedule showing only the early start, early finish of each work activity. The 90-Day Schedule shall contain work activities over the first 90 days, and the estimated durations for each work activity shall be 15 workdays or less. The balance of the job shall be shown in summary log. The 90-Day Schedule shall include but not be limited to site work, hazardous material removal, demolition, key procurement activities (i.e., submissions, approvals, fabrication, and delivery), equipment, mechanical, electrical, and plumbing coordination and any other work that will occur during the first 90 days. This 90-Day Schedule shall become part of the Detailed CPM Schedule.

1.03 DEFINITIONS

The following terms used in this Section shall have the following meanings:

A. *Activity.* A fundamental unit of work in a CPM Schedule establishing the time and resources required for performing or furnishing a part of the Work or a requisite step. Each Activity has defined geographical boundaries, time duration in days, and a detailed estimate of resources required to construct the task. Each activity is assigned a unique description, activity number, activity code, and a dollar value.

B. *Record Schedule.* The Record Schedule will have actual start dates and actual finish dates for all work Activities and Milestones necessary to complete the Work.

C. *Baseline Schedule.* The Engineer-accepted Proposed Baseline Schedule. The Baseline Schedule is the Contractor's plan which has been approved by the Engineer for completion of the Work in compliance with the Milestones listed in the Contract Documents and within the Contract Time. The Baseline Schedule may be revised only by the Engineer's approval of a Contractor-produced adjusted Baseline Schedule. The Baseline Schedule for the Work is the sole basis for (a) the monitoring of the Contractor's progress against Milestones and the Contract Time; (b) calculating Total Float or Contract Float; and (c) the evaluation and reconciliation of extensions in Contract Time, if any. The first Baseline Schedule shall be designated by all parties as the Baseline Schedule, Rev. 0. When Baseline Schedules are adjusted by the Contractor and approved by

the Engineer, they shall be designated as Baseline Schedule, Rev. 1, 2, 3, etc. (as appropriate) and shall replace the previously approved Baseline Schedule.

D. *Contract Float.* Workdays between the Contractor's expected date for early completion of the Work, or specified part, and the corresponding Contract Time.

E. *CPM Network.* The structure of the computerized schedule. The CPM Network accounts for the entire Work and defines the construction logic in terms of all of the Activities with their logical dependencies.

F. *Critical Path.* A series of Activities linked by dependencies that determine the shortest possible time to complete the Work.

G. *Early Dates.* The early start dates and early finish dates, i.e., the dates each Activity will start and finish if each is started at the earliest end of the range of dates that the CPM indicates the Activities can be performed.

H. *Excusable Delay.* An unforeseeable delay, beyond the control of the Contractor, experienced due to no fault or negligence by the Contractor, its subcontractors, or suppliers.

I. *Free Float.* The amount of time that any activity can be delayed without adversely affecting the early start of the following activity.

J. *Fragnet.* A predefined or individual segment of a network which represents a specified sequence of the Work. Fragnets shall be submitted which include all Activities, required resources, and costs and shall be submitted to the Engineer for approval of all Change Orders before their incorporation into the Baseline Schedule by the Contractor. A Fragnet shall be submitted before approval of any proposed logic changes. Fragnets are banded Activities representing a revised portion of the Baseline Schedule and shall be logically connected and constrained by previously existing predecessor and successor Activities, as applicable.

K. *Late Dates.* The late start dates and the late finish dates, i.e., the dates each Activity will start and finish if each is started at the latest end of the range of dates that the CPM Network indicates the Activities can be performed and still achieve the Milestones and Contract Time.

L. *Milestone.* A point of progress designated for the purpose of establishing start or finish times for a key aspect of the Work.

M. *Predecessor Activity.* An Activity which precedes another Activity (to which it is logically tied) in the CPM Network.

N. *Preliminary Schedule*. The Contractor's Baseline Schedule for the first 180 days of the Contract.

O. *Proposed Baseline Schedule.* The Proposed Baseline Schedule shall represent the Contractor's plan for completion of the Work in compliance with Milestones listed in the Contract Documents and within the Contract Time. It represents the Contractor's first complete planned schedule submitted for review and approval by the Engineer. The Proposed Baseline Schedule shall take into account all foreseeable activities to be accomplished by any separate contractors, utility owners, or the Owner's operations. The Proposed Baseline Schedule shall anticipate all necessary manpower and resources to accomplish activities within the durations set forth in the Proposed Baseline Schedule. The Proposed Baseline Schedule shall address and indicate all submittals required by the Contract and indicate the times allowed for review, resubmittal, and approval of submittals. Upon approval by the Engineer, the first Proposed Baseline Schedule shall become the Baseline Schedule, Rev. 0.

P. *Resource Loading.* The allocation of work force and equipment necessary for the completion of an Activity as scheduled.

Q. *Six-Week Schedule.* A detailed progress schedule taken from the Working Schedule, which discloses the plan for the next 6 weeks' Work and the actual schedule for the previous 6 weeks' Work.

R. *Successor Activity.* An Activity which follows another Activity (to which it is logically tied) in the CPM Network.

S. *Total Float.* The number of workdays by which a part of the Work in the Baseline Schedule or Revised Baseline Schedule may be delayed from its Early Dates without necessarily extending the Contract Time.

T. *Working Schedule.* When the Proposed Baseline Schedule (or a subsequent adjustment is made by the Contractor to the Baseline Schedule) is accepted by the Engineer and becomes the Baseline Schedule, Rev. 0, 1, 2, 3, etc., it shall be duplicated and become the Working Schedule. The Contractor shall update the Working Schedule monthly with a Data Date designated by the Engineer. The Working Schedule shall be updated monthly to reflect actual progress only and shall be the basis for determining monthly progress payments and the Contractor's performance in relation to the most recently approved Baseline Schedule. The Final Working Schedule shall be the Record Schedule.

1.04 DETAILED CPM SCHEDULE

A. The Detailed Network Diagram shall provide sufficient detail and clarity of form and technique so that the Contractor can plan, schedule, and control his work properly and the Engineer can readily monitor and follow the progress for all portions of the Work. The Detailed Network Diagram shall comply with the Contract Times of the Agreement and various limits imposed by the Contract Documents, including required sequencing of portions of the Work described in Section 01100, Summary of Work. The degree of detail shall be to the satisfaction of the Engineer, but the following factors shall have a bearing on the required depth of activity detail:

1. The structural breakdown of the Project.
2. Project phasing and/or milestones.
3. The type of work to be performed and the labor trades involved.
4. All purchase, manufacture, and delivery activities for all major materials and equipment.
5. Maintenance of facilities in operation.
6. Submittal and approval of shop drawings and material samples.
7. Plans for all subcontract work.
8. Crew flows and sizes.
9. Assignment of responsibility for performing all activities.
10. Access and availability to work areas.
11. Identification of interfaces and dependencies with preceding, concurrent, and follow-on subcontractors and contractors.
12. Testing and start-up of systems.
13. Planning for phased takeover by the Owner.

B. Activities shown shall be in workdays and shall have a maximum duration of 5 days, except in the case of non-construction activities such as procurement of materials and delivery of equipment. All durations shall be the result of definitive manpower and resource planning by the Contractor.

C. The Detailed Network Diagram shall be prepared using a computer plotter.

1.05 COMPUTERIZATION OF THE DETAILED CPM SCHEDULE

A. The mathematical analysis of the Detailed Network Diagram shall be made by computer, and a tabulation for each activity shall include the following:

1. Unique event numbers.
2. Activity descriptions.
3. Durations in workdays for each activity.
4. Earliest start date (by calendar date).

5. Earliest finish date (by calendar date).
6. Latest start day (by calendar date).
7. Latest finish day (by calendar date).
8. Slack or total float in workdays.
9. Percentage of activity completed.

B. The following computer outputs shall be prepared as part of the initial schedule submission and each update thereafter:

1. Activity file sort.
2. Eight-week "Look Ahead" detailed bar chart.
3. Summary bar chart.
4. Additional computer sorts to the schedule as required by the Owner.

1.06 COMPLETION REQUIREMENT

A. The 90-Day Schedule shall be completed and submitted at the pre-construction meeting as specified in Section IV, Article 209, of the City's Technical Specifications.

B. The Detailed CPM Schedule shall be prepared within 30 calendar days after the date indicated in the Notice to Proceed.

C. If the Contractor fails to provide the required CPM scheduling documents to the Engineer within the time prescribed and/or revisions of the scheduling documents within the required time, the Contractor shall be in default of the Contract requirements and the Engineer may withhold approval of progress payments until such time as the Contractor submits the required information.

D. Notwithstanding the implementation of the Progress Schedule, it shall be the sole responsibility of the Contractor to complete the Work within the time of completion required by the Contract.

1.07 UPDATINGS

A. The 90-Day CPM Schedule shall be updated monthly until the Engineer accepts the Detailed CPM Schedule.

B. The first update of the Detailed CPM Schedule shall take place 60 calendar days after the Notice to Proceed with subsequent updates performed monthly at the jobsite for the duration of the contract.

C. The Contractor shall update the Detailed CPM Schedule monthly, using a cutoff/data date agreeable to the Contractor and the Engineer. This cutoff/data

date shall be consistent from month to month. The update information shall include but not be limited to the following:

1. Actual start dates.
2. Actual completion dates.
3. Activity percent completion.
4. Remaining duration of activities in progress.

D. The Contractor shall update all the scheduling documents and submit these documents to the Engineer within 5 workdays of the cutoff/data date.

E. The Contractor shall submit seven copies of the CPM schedule and one electronic copy of the CPM schedule on a CD.

F. As part of the normal CPM update, the Contractor shall prepare a written narrative report highlighting the progress during the past update period. The written narrative report shall include but not be limited to the following information:

1. Summary of work accomplished during the past update period.
2. Milestone Comparison Chart.
3. Analysis of Critical Path(s).
4. Analysis of Secondary Critical Path(s). Secondary Critical Path is defined as float within 10 workdays of Critical Path.
5. Analysis of time lost/gained during the update period.
6. Identification of problem areas.
7. Identification of change orders and/or any delay that is impacting/delaying the project schedule.
8. Solutions to current problems.

G. The Contractor is required to attend and participate in a CPM update review meeting with the Engineer. Attendance is mandatory. This meeting will take place 7 workdays after the cutoff/data date, or during progress meetings as decided by the Owner and the Engineer. The purpose of this meeting is to review past progress, current status, problem areas, and future progress. The Contractor's narrative report will be reviewed at this meeting.

H. All schedule update information outlined above will be reviewed and accepted by the Engineer.

1.08 RECOVERY SCHEDULE

A. If the Contractor fails to achieve the planned progress, as indicated in the approved/updated detailed CPM Schedule, and the Contractor's lack of progress

delays the Critical path and/or an intermediate milestone by more than 10 workdays (monthly or cumulatively), the Contractor shall submit to the Engineer for review and acceptance a proposed Recovery Schedule indicating how the Contractor will recover the time lost.

B. If the Contractor fails to submit a Recovery Schedule and/or fails to cooperate with the Engineer in the Recovery Schedule process, the Owner can immediately order the Contractor to accelerate completion of the late activities which have been delayed by whatever means necessary without any additional costs to the Owner. The Owner can withhold future progress payments until the Contractor's progress is in compliance with the Contract Schedule or until the Owner has approved by Change Order proposed adjustments to the contract milestones, extension of contract time, or modification of the Contract Schedule.

1.09 CHANGE ORDERS, DELAYS, AND EXTENSIONS OF TIME

A. When proposed Change Orders, approved Change Orders, or any delays are experienced and the Contractor believes the Change Order/Delay is causing delay to an intermediate contract milestone or to the project completion, the Contractor shall submit to the Engineer a Time Impact Analysis, explaining the influence of each Change Order/Delay on the current updated Contract CPM Schedule. The Contractor shall prepare a "Fragnet" (network analysis) of each Change Order/Delay on the current updated Contract CPM Schedule. The analysis will demonstrate the time impact based on the date the change is given to the Contractor, the status of construction at that point in time, and the event time computation of all affected activities. The event times used in the analysis shall be those included in the latest updated copy of the detailed CPM Schedule closest to the time of delay or as accepted by the Engineer.

B. For the Contractor to be entitled to an extension of Contract time to an intermediate contract milestone and/or to the project completion, the Time Impact Analysis must show that the Change Order/Delay impacts the intermediate contractual milestone date and/or the updated CPM Schedule's Critical Path, thereby directly impacting the project completion date. Change Orders/Delays that do not impact intermediate contractual milestones and/or the critical path and impact activities with float will not be considered as a delay to the project and no extension of time will be granted.

C. The Contractor must submit a written analysis within 7 calendar days after a delay occurs or authorized change in work is given to the Contractor. If the Contractor does not submit a written analysis for specific Change Order(s) or Delay(s) within the specified period of time, then it is mutually agreed that the particular Change Order of Delay has no time impact on the Project CPM Schedule and no time extension is required.

D. The Engineer will accept or reject each Time Impact Analysis within 14 calendar days after submittal unless subsequent meetings and negotiations are necessary. Upon the Engineer's acceptance, the Contractor will incorporate fragnets illustrating the influence of the Change Orders and Delays into the Detailed CPM Schedule during the first update after agreement is reached.

1.10 PROGRESS MEETINGS

A. The Owner will conduct progress meetings at least once per month to discuss the progress of the Work. The Contractor and any subcontractors the Contractor deems necessary shall attend these meetings. At the Owner's discretion, the frequency of the meetings may be increased if the progress of the Work is not satisfactory or if coordination problems should arise.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01325
CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall have digital photos and videos made of the Work from views and at such times as directed by the Owner. These photos and videos shall represent a visual history of the Project, from Contract Award through Contract Completion.

B. The requirements of this Section constitute a minimum requirement, but the Owner may request additional photos or videos at their discretion for complete documentation of the work performed.

C. The Contractor shall also use additional digital photography as necessary to record and facilitate resolution of on-site issues through the transmission of photos by e-mail or other electronic submittal forum from the site to the Owner's offices.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 DIGITAL PHOTO REQUIREMENTS

A. Digital photos shall be in color. Provide one copy of each digital photo via electronic submittal to the Owner.

B. Provide photos taken of each of the major items during construction.

C. View and Quantities Required: A minimum of 30 photos per month clearly showing project status and key elements of construction.

D. Deliver digital photos to the Owner on a monthly basis.

E. Photographs shall be from locations to illustrate the condition of construction and the state of progress adequately.

F. The Contractor shall provide before and after photos of each portion of the site. The below-ground facilities shall include before, during, and after photos of all equipment, walls, floor, piping, utility crossings, and supports. At major locations,

photos shall include before, during, and after prints and all prints all submitted electronically in ascending date order to show the Work as it progresses.

3.02 DIGITAL VIDEO RECORDING REQUIREMENTS

A. The Contractor shall provide to the Owner color digital video of each major facility and structures and facilities adjacent to the construction before construction starts, during construction, and when construction has been completed. Videos shall include the entire site and areas of adjacent properties within 100 feet of the limit of the Work. Special effort shall be made to show the existing improvements and features affected by the work.

B. Approximately every 2 weeks, 5 minutes of digital video shall be submitted to the Owner showing Work completed, Work in progress, Work started, and problems that occurred since the last digital video was made.

C. The Contractor shall maintain the master video of each portion of the facility on the Work site. The master video shall be a running chronicle of construction progress. The Contractor shall combine the bi-weekly video onto the master video.

D. The bi-weekly video shall be submitted to the Owner within 10 working days after recording and the bi-weekly videos may include multiple locations.

E. All videos shall be recorded with character generator operating with date, time, and location on screen. During video recording, the Contractor shall narrate the video, explaining what is being shown, problems that have occurred, and what is being done.

3.03 AERIAL PHOTOS AND VIDEOS

A. The Contractor shall obtain digital, true-color, aerial photos and aerial videos using aerial drones or other approved means of the entire project site before construction begins**,** during construction at a point directed by the Owner, and at final completion showing the entire completed construction project.

B. The Contractor is required to secure all permits and approvals from authorities having jurisdiction before any aerial or drone flights and shall have licensed pilots/drone pilots performing the flights in accordance with applicable regulations.

C. Provide a minimum of 10 aerial digital photos from each flight.

D. Aerial videos shall be a minimum of 5 minutes in length or as needed to show the projects from all sides with slow panning, tilting, and/or translating views of the work sites.

E. Provide a digitally collected orthophoto mosaic supplied in Geotiff format via digital submittal of both pre-construction and post-construction conditions. The final color-balanced, true-color orthophoto mosaic will be projected in North American Datum of 1927 (NAD 27), state plane west, and all vertical reference shall be North American Vertical Datum of 1988 (NAVD 88), US feet, and shall meet a final accuracy of plus or minus 5 feet.

F. The Contractor shall submit an aerial photo and video plan to the Owner for approval before conducting the work. The plan shall include a description of the proposed views, lengths of each scene, equipment to be used, schedule, and other relevant information to ensure the Owner's needs are met.

3.04 PHOTO AND VIDEO INFORMATION

A. Each digital photo and video file shall be digitally tagged with the following data or the file name shall be referenced from a log that contains the following information for each photo and video:

1. Digital photo or video digital file name/number.
2. Project name.
3. Contract number.
4. Name of Contractor.
5. Date photo or video was taken.
6. Photographer name.
7. Description of location, view, and construction items the photo displays.

B. All photos and videos shall be clear, unobstructed, sharply focused, and free of distortion.

END OF SECTION

SECTION 01330
SUBMITTALS AND ACCEPTANCE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall submit documentation that describes the Work to be performed under the Contract as required in this Section. This documentation will be for the Engineer and Owner's review and use. The documentation furnished by the Contractor must enable the Engineer and Owner to verify the Contractor's performance and compliance with Contract requirements. The documentation shall cover all services and deliverables required and secured by the Contract Documents.

1.02 SUBMITTALS

A. General—The Contractor shall submit the following:

1. Project documentation: For the Engineer and Owner's internal use and shall include all information that will be essential for the facility's operations, maintenance, training, and repair of equipment and facilities supplied by the Contractor. The Contractor shall submit all documentation necessary to ascertain compliance with technical/contractual provisions.
2. Shop drawings: Drawings, schedules, diagrams, warrant, and other data prepared specifically for this Contract by the Contractor or through the Contractor by way of subcontractor, manufacturer, supplier, distributor, or other lower-tier contractor to illustrate a portion of the Work.
3. Product data: Preprinted materials such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate a portion of the Work, but not prepared exclusively for this Contract.
4. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to portions of the Work, illustrating portions of work, or establishing standards for evaluating appearance of finished work or both.
5. Installation Lists: All manufacturers or equipment suppliers who propose to furnish equipment or products shall submit an installation list to the Owner with the required Shop Drawings. The installation list shall include all installations where identical equipment has been installed and has been operating for at least 1 year.

6. Administrative submittals: Data presented for reviews and acceptance to ensure that administrative requirements of the project are adequately met but not to ensure directly that work is in accordance with the design concept and in compliance with Contract Documents.

7. Mockups: Before installing work requiring mockups, the Contractor shall build mockups for each form of construction and finish required using materials indicated for the completed Work, as follows:

    a. Build mockups in the location and of the size directed by the Engineer.
    b. Notify the Engineer 7 days in advance of dates and times when mockups will be constructed.
    c. Demonstrate the proposed range of aesthetic effects and workmanship.
    d. Obtain the Engineer’s acceptance of mockups before starting work, fabrication, or construction.
    e. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
    f. Demolish and remove mockups when directed by the Engineer.

B. Coordination

1. Submittals and schedules shall be checked and coordinated with the Work of all trades involved before they are submitted and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.

C. Start of Work

1. Within 30 calendar days after the Notice to Proceed for the project, the Contractor shall submit to the Engineer a Contract Data Requirements List that defines all data to be submitted under this Contract. Included in this list shall be the names of all proposed manufacturers furnishing specified items to the extent known. Review of this list by the Engineer shall in no way relieve the Contractor from providing materials, equipment, systems, and structures fully in accordance with the Specifications.

D. General Requirements

1. The Contractor shall prepare, assemble, and submit all documents as described herein. The Contractor shall submit certification that the documents prepared conform to the Contract requirements and will result in a complete and operable project. The Owner shall review the

Contractor’s documents for conformance to the Contract requirements and may comment on the documents.

2. The Contractor shall approve and certify all project documents. The Contractor’s failure to certify the documents or failure to provide documents that demonstrate conformance to the Contract requirements are grounds for rejection. The Contractor shall be responsible for and bear all costs for proceeding with any part of the Work that fails to meet the Contract requirements.
3. Submittal of documents for the Engineer’s review shall in no way relieve the Contractor of full responsibility for providing a complete, safe, reliable, operating, and coordinated Work (system/equipment/facilities) that comply with these Contract documents.

E. Requests for Substitution

1. All requests for substitution shall clearly and specifically indicate any and all differences or omissions between the products specified as basis of design and the product proposed for substitution. Data shall include but not be limited to differences as follows for both the specified and substituted products:

    a. Principle of operation.
    b. Materials of construction or finishes.
    c. Thickness or gauge of materials.
    d. Weight of item.
    e. Deleted features or items.
    f. Added features or items.
    g. Changes in other work caused by the substitution.
    h. If the substitution contains differences or omissions not specifically called to the attention of the Engineer, the Engineer reserves the right to require equal or similar features to be added to the substituted product at the Contractor's expense.

F. Submittal Requirements and Procedures

1. Drawing Formats and Requirements

    a. Drawings—All Drawings and Shop Drawings shall be prepared in 24-x-36-inch or larger format and shall have a blank area of 3 x 4 inches in the lower right hand corner above the title block. Each Drawing shall indicate the following information in the title block:

        (1) Title and Drawing Number.

(2) Date of Drawing or Revision.
(3) Name of Building or Facility.
(4) Name of Contractor or subcontractor.
(5) Drawing Contents and Locations.
(6) Specification Section and Subsection Numbers.

b. All drawings shall be submitted via electronic transmittal in PDF format or other formats as may be required by the Owner for review.

2. Product Data

a. Requirements—Product data shall include all catalog cuts, performance surveys, test reports, equipment lists, material lists, diagrams, pictures, and descriptive material. All product data shall be submitted in either 8.5-x-11-inch or 11-x-17-inch size formats. The submittal information shall show the standard and optional product features, as well as all performance data and specifications. The manufacturer's recommendation for special tools shall be supplied.
b. All product data shall be submitted via electronic transmittal in PDF format or other formats as may be required by the Owner for review.

3. Samples—The Contractor shall furnish samples required by the Contract Documents, for review by the Owner. Samples shall be delivered to the Engineer as specified or directed.

a. All samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices. The samples shall show the full range of color, texture, and pattern.
b. The Contractor shall submit a minimum of four samples of items submitted. All samples shall be marked with required submittal information, as specified above.

4. Color, Texture, and Pattern Charts

a. The Contractor shall submit color, texture, or pattern charts of all required finishes.
b. A minimum of four charts of each item shall be submitted.

5. Submittal Information Requirements

a. When used in the Contract Documents, the term "Submittal Information" shall be considered to mean the following information at a minimum:

(1) Contract Name.
(2) Contract Number.
(3) Location Within Facility.
(4) Date Submitted.

b. Drawings—The Contractor shall mark submittal information on all Drawings in the left half of the 3-x-4-inch block as described above.

c. Product Data and Manufacturer's Literature—The Contractor shall mark all product data and manufacturer's literature with submittal information and note which item is being furnished. The Contractor shall mark the option and supplies to be furnished with the item. Do not submit the manufacturer's general catalog: submit only items being installed or delivered. When manuals are being submitted, the Contractor shall mark submittal information on both the cover and title page. If manuals being submitted contain more than just one item, each item must be marked, and only Contract name and number is to be marked on the cover and title page.

6. Training, Operation and Maintenance Manuals

a. The Contractor shall submit to the Engineer for review and acceptance of manufacturer's installation, operations, lubrication, maintenance, and training manuals for all equipment installed or delivered under this Contract. All manuals shall have submittal information marked on the front cover, title page, and three places inside the manual. If the manual being submitted is for different components, mark the front cover and title page only. Each component section must be marked with the Specification Section and subsection numbers.

b. Operations and Maintenance Manual shall conform to requirements defined in Section 01830, Operations and Maintenance Manuals.

G. Required Submittals

1. Architectural and Structural Submittals

a. This Section specifies general procedural requirements for contractual submittals for the following structural schedules, product data, samples, and manufacturer's certificates.

(1) Product Data—The Contractor shall provide product data for all architectural and structural items, options, and other data and provide supplemental manufacturer's standard data for information unique to the Work and installation. The submittals shall reflect all items delivered or installed under this Contract.

(2) Samples—The Contractor shall provide all samples required under this Specification including color charts and product samples.

(3) Material, equipment, and installation and demolition Specifications.

2. Mechanical and Electrical System Submittals

a. This Section specifies general procedural requirements for mechanical schedules, performance data, control diagrams, and other submittal data.

b. The Contractor shall submit the following:

(1) Performance Data.

(2) Power and Riser Diagrams—Single line riser, power diagrams, and all conduit runs shall be provided for all equipment and facilities.

(3) Wiring Diagrams—Elementary controls diagrams and separate wiring diagrams for mechanical and electrical unit/subsystem. Drawing for starting and shutdown of equipment including controls shall be provided, including a comprehensive description of operation.

(4) Finished Data—Complete surface preparation and finished data for all mechanical and electrical unit/subsystems shall be provided, including a complete list of cleaning instructions.

(5) Factory Testing—Detailed description of factory testing procedures, reporting procedures and criteria for test passing or failing shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with the General Requirements and Technical Requirements Sections.

(6) Site (Field) Testing and Acceptance—Detailed description of site testing and acceptance tests including descriptions of procedures, testing equipment, reporting procedures, and criteria for passing or failing tests shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with General Requirements and Technical Requirements.

(7) Factory Test Report—After fabrication and testing, the Contractor shall submit the results of tests. No shipment of any mechanical and electrical unit/subsystem shall be allowed without the written certification from the Contractor that the equipment conforms to the Contract requirements.

(8) Site Test and Acceptance Report—Site test and acceptance reports shall be submitted to the Owner and Engineer.

(9) Operations and Maintenance Manuals—The Contractor shall furnish manuals for all mechanical and electrical equipment specified under this Contract. Each manual shall include the following at a minimum:

(a) Description of equipment.
(b) Record shop drawing.
(c) Operation and maintenance instructions.
(d) Part lists.
(e) Equipment ratings.
(f) Valve list.
(g) Lubrication instructions.

c. Compliance with this Section does not relieve the Contractor from compliance with the requirements of Section 01830, Operations and Maintenance Manuals.

H. Submittal Review

1. The Owner's review of the Contractor's documents shall not relieve the Contractor of the responsibility for meeting all of the requirements of the Contract nor of the responsibility for correcting the documents furnished. The Contractor shall have no claim for additional cost or extension in time because of delays due to revisions of the documents that may be necessary for ensuring compliance with the Contract.

2. The Engineer will review a submittal or re-submittal once, after which the cost of review shall be borne by the Contractor. The cost of Engineering shall be equal to the Engineer's full cost.

3. No partial submittals will be reviewed. A submittal or re-submittal not complete will be returned to the Contractor for completing and re-submittal.

4. Documents submitted by the Contractor for approval by the Engineer will be returned bearing a project-specific stamp bearing the dated signature of the reviewer and one of four boxes checked:

    a. NO EXCEPTIONS NOTED—This indicates that the submittal appears to comply with the requirements of the performance specifications and that the Work may proceed.
    b. MAKE CORRECTIONS NOTED—This indicates that the reviewer has added a minor correction to the submission and that the Work (modified in accordance with the correction comment) may proceed. The Contractor shall accept the responsibility of the modified document and resulting Work with no additional compensation.
    c. AMEND AND RESUBMIT—This indicates that the submittal will require Contractor modifications based on the reviewer's comments that accompanied the returned submittal. The Contractor will be cautioned that work may not proceed under this review status.
    d. REJECTED—This indicates that the submittal is not in conformance with the requirements of the performance Specifications and cannot be modified to gain compliance. A new submittal will be required in the instance of a "reject" status and the Contractor will be cautioned that work may not proceed under this condition.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL PROCEDURES

A. Before submitting documents for the Owner’s review, the Contractor shall review the documentation for conformance to the Contract requirements. Submittals shall be complete and comprise a logical division of the Contract Work.

B. All documentation submitted by the Contractor to the Engineer shall be accompanied by a letter of transmittal and shall be submitted in a sequence that allows the Engineer to have all of the information necessary for checking and accepting a particular document at the time of submittal.

C. Each document shall be identified by a document number, Contract number, Contract name, location, Specification Section, subsection numbers, and submittal date. Where a manual/drawing is revised to reflect a change in design or a change for any other reason, each such revision shall be shown by a revision number, date, and subject in a revision block. Indication of official approval by the Contractor's Project Manager shall also be included. To permit rapid location of the revision, additional notation shall be made in the manual opposite the line or area where the change was made and identified by the corresponding revision number.

3.02 DOCUMENTATION CONTROL AND SUBMITTAL SEQUENCING

A. The Contract Data Requirements List shall be updated and resubmitted to the Owner monthly, throughout the duration of the Contract. This list shall identify the Contractor’s submittal number, proposed and actual submittal date, Contract Specification Section Number, Paragraph, Item of the Work, and type of document.

B. The Contractor shall work with the Engineer to provide a regulated flow of submittals that allows the Engineer to review the submittals in the defined time frame without undue delays. Monthly the Contractor shall provide the Engineer a schedule of the approximate quantities and delivery dates for all submittals due for the next 120 days.

3.03 FINAL DRAWINGS

A. The Contractor shall submit the Final Drawing Package to the Engineer for review at Substantial Completion. The Contractor shall be provided with files of the Contract Drawings in AutoCAD or Autodesk DWG, as specified by the Owner. Final Drawings shall be prepared in AutoCAD or Autodesk DWG with the same version used for the Contract Drawings and shall be provided

electronically in AutoCAD or Autodesk DWG. The Contractor may request to use a different version, but it must be approved by the Engineer.

B. Final Drawings shall also be provided in hardcopy format, two copies, printed at the full size of the original Contract Drawings, 24 by 36 inches at a scale of 1 inch = 20 feet.

3.04 REQUIREMENTS FOR SUBMITTAL

A. Additional documents, drawings, interface data, and other pertinent project submittal data are listed in specific sections of this Contract.

3.05 RECORD PRINTS

A. The Contractor shall submit one set of all record prints before final completion. The record print or project records shall include submittals, catalog cuts, drawings, calculations, test reports, manufacturer's data, maintenance manuals, installation instructions, and operating manuals. All "record prints" shall be delivered to the Owner in three-ring binders with dividers and shall be placed in order by Specification Section.

END OF SECTION

SECTION 01350
ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work covered by this Section consists of furnishing all labor, materials, and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations during and as the result of construction operations under this Contract. In this Section *environmental pollution* is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare, unfavorably alter ecological balances of importance to human life, affect other species of importance to man, or degrade the utility of the environment for aesthetic and/or recreational purposes.

B. The control of environmental pollution requires considering air, water, and land and involves managing noise and solid waste as well as other pollutants.

C. The Contractor shall schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the Work. The Contractor shall provide erosion-control measures such as diversion channels, sedimentation or filtration systems, berms, staked silt fence, seeding, mulching or other special surface treatments that are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion-control measures shall be in place in an area before any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in Section 02370, Erosion and Sedimentation Control.

D. This Section is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.

E. All phases of sedimentation and erosion control shall comply with and be subject to the laws of the State of Florida and the Project Environmental Resource Permit.

1.02 WORK SEQUENCE

A. Before beginning the Work, the Contractor shall meet with the Engineer to establish agreed-upon compliance with these provisions and administration of the environmental pollution control program.

B. The Contractor shall remove temporary environmental control features when approved by the Engineer and incorporate permanent control features into the project at the earliest practicable time.

1.03 REFERENCE STANDARDS

A. Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

B. The Contractor shall comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EROSION CONTROL

A. The Contractor shall provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion-control measures, such as temporary vegetation, siltation basins, mulch check dams, mulching, jute netting, and other equivalent techniques shall be used as appropriate. Surface water shall be prevented from flowing into excavated areas. At the completion of the Work, erosion and sedimentation controls shall be removed and the ground surface restored to its original condition.

3.02 PROTECTION OF STREAMS AND SURFACE WATERS

A. Care shall be taken to prevent or reduce to a minimum any damage to any stream or surface water from pollution by debris, sediment, or other material or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing or that contains oils or sediments that will reduce the quality of the water in the stream shall not be directly returned to the stream. Such waters shall be diverted through a settling basin or filter before being directed into streams or surface waters.

B. The Contractor shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water, or any storm sewer. Water from dewatering operations shall be treated by filtration, settling

basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.

C. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the FDEP. The Contractor shall submit two copies of approved contingency plans to the Engineer.

D. Water being flushed from structures or pipelines after disinfection with chlorine shall be treated with a dechlorination solution approved by the Engineer before discharge.

3.03 PROTECTION OF LAND RESOURCES

A. After completion of construction, the Contractor shall restore land resources within the project boundaries and outside the limits of permanent work to a condition that will appear to be natural and not detract from the appearance of the project. All construction activities shall be confined to areas shown on the Drawings.

B. Outside of areas requiring earthwork for the construction of the new facilities, the Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, the Contractor shall first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.

C. The Contractor shall protect trees that may possibly be defaced, bruised, injured, or otherwise damaged by the construction equipment, dumping, or other operations by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly.

D. Any trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to their original condition. The Owner will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of.

1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1 inch in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning

shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.

2. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and, in the opinion of the Owner, are beyond saving shall be immediately removed and replaced.

E. The Contractor's storage and other construction buildings required temporarily in the performance of the work shall be located in cleared portions of the job site or areas to be cleared as shown on the Drawings and approved by the Engineer and shall not be within wetlands or floodplains. Preserving the landscape shall be required in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for the Engineer's approval.

F. If the Contractor proposes to construct temporary roads or embankments and excavations for plant and/or work areas, the Contractor shall submit the following for approval at least 10 days before the scheduled start of such temporary work:

1. A layout of all temporary roads, excavations, embankments, and drainage to be constructed within the work area.
2. Details of temporary road construction.
3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed materials.
4. Landscaping drawings showing the proposed restoration of the area. The proposed removal of any trees and shrubs outside the limits of the existing clearing area must be indicated. Locations of guard posts or barriers required to control vehicular traffic and protect trees and shrubs to be maintained undamaged must also be indicated. The drawings shall provide for the obliteration of construction scars as such and shall provide for a natural appearing final condition of the area. Modification of the Contractor's approved drawings shall be made only with the written approval of the Engineer. No unauthorized road construction, excavation, or embankment construction including disposal areas will be permitted.

G. The Contractor shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess waste materials, or any other vestiges of construction as directed by the Engineer. Excavating, filling, and plowing of roadways are expected to be required to restore the area to near natural conditions which will permit the growth of vegetation the roadway areas. The disturbed areas shall be prepared and seeded as approved by the Engineer or Owner.

H. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.04 PROTECTION OF AIR QUALITY

A. Burning—Burning will not be permitted at the project site for the disposal of refuse and debris.

B. Dust Control—The Contractor shall maintain all excavations, embankment, stockpiles, access roads, waste areas, borrow areas, and all other work areas within or outside the project boundaries free from dust which could cause the standards for air pollution to be exceeded and which would cause a hazard or nuisance to others.

C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products is prohibited. The use of chlorides is prohibited.

D. To be approved, sprinkling must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor shall have sufficient competent equipment on the job to accomplish this. Dust control shall be performed as the Work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Owner.

3.05 NOISE CONTROL

A. The Contractor shall make every effort to minimize noises caused by the construction operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal and State regulations.

3.06 MAINTENANCE OF POLLUTION-CONTROL FACILITIES DURING CONSTRUCTION

A. During the life of this Contract, the Contractor shall maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

3.07 PERMIT COMPLIANCE REQUIREMENTS

A. The Contractor shall comply with all conditions of permits and crossing agreements obtained by the Owner or required to be obtained by the Contractor, including but not limited to:

1. City of Clearwater.
2. Pinellas County.

END OF SECTION

SECTION 01355
SPECIAL PROVISIONS

PART 1 GENERAL

1.01 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.02 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. National Electrical Code (NEC)

1. NEC Article 460—Equipment for General Use – Capacitors.

1.03 WARRANTIES

A. Warranties shall be in accordance with the General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

B. Unless specified otherwise in the Contract Documents, all equipment supplied under these Specifications shall be warranted by the Contractor and the equipment manufacturers for 1 year. The warranty period shall begin on the date of Owner Final Acceptance.

C. The equipment shall be warranted to be free from defects in workmanship, design, and materials. If any part of the equipment fails during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to the Owner.

D. The manufacturer’s warranty period shall run concurrently with the Contractor’s warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining equipment warranties in accordance with Section 01780, Warranties and Bonds, from each of the respective suppliers or manufacturers for all the equipment specified under Divisions 11, Equipment; 15, Mechanical; and 16, Electrical.

E. If the manufacturer is unwilling to provide a 1-year warranty beginning at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a 2-year warranty starting at the time of equipment delivery to the job site. This 2-year warranty shall not relieve the Contractor of the 1-year warranty starting at the time of Owner acceptance of the equipment.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.05 INSTALLATION OF EQUIPMENT

A. The Contractor shall take special care to ensure proper alignment of all equipment with particular emphasis on the pumps and electric drives. The units shall be carefully aligned on their foundations by qualified millwrights after the units' sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the Engineer has approved the foundation alignments, the bedplates or wing feet of the equipment shall be securely bolted in place. The Contractor shall further check the alignment of the equipment after it is secured to the foundations and, after all alignments are conformed, shall grout the sole plates in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping and under no circumstances will pipe springing be allowed.

B. The Contractor shall furnish all wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level, and secure apparatus in place. All parts intended to be plumb or level must be proven to be exactly so. The Contractor shall perform all grinding necessary to bring parts to proper bearing after erection.

1.06 SLEEVES AND OPENINGS

A. The Contractor shall provide all openings, channels, chases, etc., in new construction and furnish and install anchor bolts and other items to be embedded in concrete as required to complete the Work under this Contract. The Contractor shall perform all cutting, coring, and rough and finish patching required in existing construction for the work of all trades.

B. Subcontractors shall furnish all sleeves, inserts, hangers, anchor bolts, etc., required for the execution of their work. Before the work of the Contractor begins, the subcontractors shall be responsible for furnishing the Contractor with the above items and with templates, drawings, or written information covering

chases, openings, etc., which they require and to follow up the work of the Contractor as it progresses, making sure that their drawings and written instructions are carried out. If the subcontractors fail to do this, they shall be responsible for the cost of any corrective measures that may be required to provide necessary openings, etc. If the Contractor fails to carry out the directions given him, covering details and locations of openings, etc., he shall be responsible for any cutting and refinishing required to make the necessary corrections. In no case shall beams, lintels, or other structural members be cut without the Engineer's approval.

1.07 GREASE, OIL, AND FUEL

A. The Contractor shall furnish all grease, oil, and fuel required for testing equipment with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied under Divisions 11, Equipment, 15, Mechanical; and 16, Electrical.

1.08 TOOLS

A. The Contractor shall furnish any special tools (including grease guns or other lubricating devices) that may be necessary for the adjustment, operation, and maintenance of any equipment with the respective equipment.

B. Tools shall be furnished in heavy steel toolboxes complete with lock and duplicate keys.

1.09 SPARE PARTS

A. Where spare parts are specified in the Specification Sections, the Contractor shall furnish all spare parts recommended by the manufacturer or system supplier for 1 year of service. In addition, the Contractor shall furnish all spare parts itemized in each Section.

B. The Contractor shall collect and store all spare parts in an area to be designated by the Engineer and shall furnish the Engineer with an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivery cost.

C. Spare parts shall be packed in cartons properly labeled with indelible markings with complete descriptive information, including manufacturer, part number, part name, and equipment for which the part is to be used and shall be properly treated for 1 year of storage.

1.10 HURRICANE PREPAREDNESS PLAN

A. Within 30 calendar days of the date of Notice to Proceed, the Contractor shall submit a Hurricane Preparedness Plan to the Owner for approval. The Plan shall describe in detail the necessary measures that the Contractor will perform, at no additional costs to the Owner, in case of a hurricane warning. The Contractor shall revise the Plan as required by the Owner.

1.11 WEATHER PROTECTION

A. In the event of inclement weather, the Contractor shall protect the Work and materials from damage or injury from the weather. If, in the opinion of the Owner, any portion of the Work or materials has been damaged by reason of failure on the part of the Contractor to protect the Work, such Work and materials shall be removed and replaced with new materials and Work to the satisfaction of the Owner.

1.12 PROVISIONS FOR CONTROL OF EROSION

A. The Contractor shall take sufficient precautions during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride, or other polluting materials harmful to humans, fish, or other life, into the wetlands and surface waters of the State. Control measures must be adequate to ensure that turbidity in the receiving water will not be increased more than 10 nephelometric turbidity units (NTU), or as otherwise required by the State or other controlling body, in water used for public water supply or fish unless limits have been established for the particular water. In surface water used for other purposes, the turbidity must not exceed 25 NTU unless otherwise permitted. Special precautions shall be taken in the use of construction equipment to prevent operations that promote erosion.

1.13 PROVISIONS FOR THE CONTROL OF DUST AND LITTER

A. The Contractor shall take sufficient precautions during construction to minimize the amount of dust created. Wetting down the Site may be required or as directed by the Engineer to prevent dust as a result of vehicular traffic. Control of blowing litter caused by any regrading by the Contractor shall be the responsibility of the Contractor.

1.14 ON-SITE STORAGE

A. The Contractor should note that there may be special storage requirements and possible charges for noncompliance of on-site storage requirements for materials and equipment as specified in Section 01600, Materials and Equipment.

1.15 ELECTRICAL POWER AND TESTING EQUIPMENT

A. The Contractor shall furnish electric power and all equipment and tools required for testing equipment. The cost of this electric power, equipment, and tools shall be included in the prices quoted in the Bid Form.

1.16 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, the Contractor shall provide suitable insulation between adjoining surfaces to eliminate direct contact and any resulting electrolysis. The insulating material shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other approved materials.

1.17 DAMAGE DUE TO HIGH WATER

A. The Contractor will be responsible for all damage done to his work by heavy rains or floods and he shall take all reasonable precautions to provide against damages by building such temporary dikes, channels, or shoring to carry off stormwater as the nature of the work may require.

1.18 EMERGENCY PHONE NUMBERS AND ACCIDENT REPORTS

A. Emergency phone numbers (fire, medical, police) shall be posted at the Contractor’s phone and the phone’s location be made known to all.

B. Accidents shall be reported immediately to the Engineer by phone.

C. The Contractor shall document all accidents and shall submit to the Engineer a fully detailed written report about the accident after each accident.

1.19 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. The Contractor shall provide such items in accordance with the Specification on the Drawings.

1.20 SALVAGE

A. Any existing equipment or material, including but not limited to valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the Engineer or Owner and, if so, shall be excavated, if necessary, and shall be cleaned and stored on or adjacent to the Site in a protected place specified by the Engineer or loaded onto trucks provided by the Owner. Any equipment or material not worthy of salvaging, as directed by the Owner, shall be disposed of by the Contractor at a suitable location at the Contractor's expense.

1.21 WORKMANSHIP, MATERIAL, AND EQUIPMENT

A. When a particular product or products are specified or called for, the intent is and the understanding shall be that the proposal tendered by the Contractor include those products in his bid. Should the Contractor desire to substitute a product or products equal to those specified, the Contractor shall furnish information as described in the Standard General Conditions. The alternate product or products submitted by the Contractor shall meet the requirements of the Specifications and shall, in all respects, be equal to the product or products specified by name in the Specifications.

B. All apparatus, mechanisms, equipment, machinery, and manufactured articles for incorporation into the Work shall be the new and unused standard products of recognized reputable manufacturers.

1.22 OPERATING AND MAINTENANCE DATA

A. Operating and maintenance data covering all equipment furnished shall be delivered directly to the Engineer for approval within 60 days before the facility's start-up. No payment shall be made for equipment installed or stored on site until the Engineer has approved the adequacy and completeness of the operating and maintenance data. Data shall be prepared and submitted in full conformance with Section 01830, Operations and Maintenance Manuals. Final approved copies of operating and maintenance data shall have been delivered to the Engineer on the Owner's behalf 2 weeks before scheduling the instruction period with the Owner.

1.23 RESPONSIBILITY OF CONTRACTOR

A. The Contractor shall be responsible for the entire Work determined by the Drawings, Specifications, and Contract from the date of the starting of the Work until it is accepted as evidence of approval of the Completion Certificate by the Owner. The Contractor shall be responsible for removals, renewals, and replacements due to action of the elements and all other causes except as

otherwise provided in the Specifications. The Contractor shall keep the Contract under his own control and it shall be his responsibility to see that the Work is properly supervised and carried on faithfully and efficiently. The Contractor shall supervise the work personally or shall have a competent English-speaking superintendent or representative, who shall be on the site of the project at all working hours and who shall be empowered with full authority by the Contractor to direct the performance of the Work and make arrangement for all necessary materials, equipment, and labor without delay.

B. Renewals or repairs required because of defective materials or workmanship or due to the action of the elements or other natural causes, including fire and flood, before the acceptance as determined by the Completion Certificate shall be done in accordance with the Contract and Specifications at the expense of the Contractor.

1.24 CONSTRUCTION CONDITIONS AND SUBSURFACE INVESTIGATION

A. The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) or agency(ies) having jurisdiction over the Work. Wherever a difference in the requirements of a jurisdictional body and these Specifications occurs, the more stringent shall apply.

B. The Contractor shall be responsible for having determined to his satisfaction, before submitting his bid, the nature and location of the Work, the conformation of the ground, the character and quality of the substrata, the types and quantity of materials to be encountered, the nature of the groundwater conditions, the character of equipment and facilities needed before and during the execution of the Work, the general and local conditions, and all other matters which can in any way affect the Work under this Contract. The prices established for the work to be done will reflect all costs pertaining to the Work. Any claims for extras based on substrata, groundwater table, and other such conditions will not be allowed.

1.25 SUSPENSION OF WORK DUE TO WEATHER

A. During inclement weather, all work which might be damaged or rendered inferior by such weather conditions shall be suspended. The orders and decisions of the Engineer regarding suspensions shall be final and binding. The ability to issue such an order shall not be interpreted as a requirement to do so. During suspension of the work from any cause, the Work shall be suitably covered and protected to preserve it from injury by the weather or otherwise, and if the Engineer shall so direct, the rubbish and surplus materials shall be removed.

1.26 PERMITS

A. Upon notice of award, the Contractor shall immediately apply for all applicable permits, including building permits, National Pollutant Discharge Elimination System (NPDES) permits, dewatering permits, and any other required permits not previously obtained by the Engineer to do the Work from the appropriate governmental agency or agencies. No work shall begin until all applicable permits have been obtained and copies delivered to the Owner. The Contractor shall bear all costs for obtaining all permits.

1.27 PUMPING

A. The Contractor with his own equipment shall do all pumping necessary to prevent flotation of any part of the structures during construction operations.

B. For the duration of the Contract and with his own equipment, the Contractor shall pump out water and wastewater that may seep or leak into the excavations or structures.

1.28 OWNER OCCUPANCY AND OPERATION OF COMPLETED FACILITIES

A. The assumption is that portions of the Work will be completed before the entire work is completed. On completion of construction in each individual facility, including testing, if the Owner, at its sole discretion, desires to accept the individual facility, the Contractor will be issued a dated Certificate of Completion and Acceptance for each individual facility. The Owner will assume ownership and begin operation of the individual facility on that date and the 1-year guaranty period shall begin on that date. The Owner has the option of not accepting any individually completed facility, but accepting the entire Work as a whole once completed and tested.

1.29 CLAIMS FOR PROPERTY DAMAGE

A. Upon notification by the Owner or Engineer, the Contractor shall investigate each claim for property damage and shall file, within 10 days of such notification, a statement with the Owner or Engineer setting forth all facts and details relative to the claim.

1.30 DAILY REPORTS

A. The Contractor shall submit daily reports of construction activities, including non-workdays. The report shall include the following:

1. Manpower, number of workers by craft.
2. Equipment on the project.
3. Major deliveries.
4. Activities work with reference to the Critical Path Method (CPM) schedule activity numbers.
5. New problems.
6. Other pertinent information.

B. A similar report shall be submitted for/by each subcontractor.

C. The reports shall be submitted to the Engineer's Field Office within 2 days of the respective report date. Each report shall be signed by the Contractor's Superintendent or Project Manager.

1.31 CONNECTIONS TO EXISTING SYSTEMS

A. The Contractor shall perform all work necessary to locate, excavate, and prepare for connections to the terminus of the existing systems all as shown on the Drawings or where directed by the Engineer. The cost of this work and for the actual connection of the existing mains shall be included in the bid for the Project and shall not result in any additional cost to the Owner or Engineer.

1.32 COORDINATION OF WORK

A. The Contractor shall afford other contractors and the Owner reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work and shall properly connect and coordinate the Work with such other work. The Contractor shall coordinate his Work with the Owner and other contractors to store his apparatus, materials, supplies, and equipment in such orderly fashion at the site of the Work so that it will not unduly interfere with the progress of the Work or the work of any other contractors.

B. If the execution or result of any part of the Work depends on any work of the Owner or of any separate contractor, the Contractor shall, before proceeding with the Work, inspect and promptly report to the Owner in writing any apparent discrepancies or defects in such work of the Owner or of any separate contractor that render it unsuitable for the proper execution or result of any part of the Work.

C. Failure of the Contractor to inspect and report any deficiencies shall constitute an acceptance of the Owner's or separate contractor's work as fit and proper to receive the Work, except as to defects that may develop in the Owner's or separate contractor's work after completion of the Work, which the Contractor could not have discovered by his inspection before the Work was completed.

D. If the Contractor damages the work or property of the Owner or of any separate contractor on the Project or other work on the Site, or delays or interferes with the Owner's work on ongoing operations or facilities or adjacent facilities or the separate contractor's work, the Contractor shall be liable for damage caused and, in the case of another contractor, the Contractor shall attempt to settle the claim with the other contractor before the other contractor institutes litigation or other proceedings against the Contractor.

E. If a separate contractor sues the Owner on account of any damage, delay, or interference caused or alleged to have been caused by the Contractor, the Owner shall notify the Contractor, who shall defend the Owner in such proceedings at the Contractor's expense. If any judgment or award is entered against the Owner, the Contractor shall satisfy the same and shall reimburse the Owner for all damages, expenses, attorneys' fees, and other costs that the Owner incurs as a result of the judgment or award.

F. If a separate contractor causes damage to the Work or to the property of the Contractor or causes delay or interference with the Contractor's performance of the Work, the Contractor shall present directly to the separate contractor any claims it may have as a result of such damage, delay, or interference (with an information copy to the Owner) and shall attempt to settle its claim against the separate contractor before instituting litigation or other proceedings against the separate contractor.

G. In no event shall the Contractor seek to recover from the Owner or the Engineer, and the Contractor hereby represents to the Owner and the Engineer that he will not seek to recover from them, or either of them, any costs, expenses, (including, but not limited to, attorneys' fees) or losses of profit incurred by the Contractor as a result of any damage to the Work or property of the Contractor or any delay or interference caused or allegedly caused by any separate contractor.

H. The Engineer shall determine and adjust any difference or conflict that may arise between the Contractor and other contractors who may be performing work on behalf of the Owner or between the Contractor and workmen of the Owner regarding their work. If the work of the Contractor is delayed because of any acts or omissions of any other contractor of the Owner, the Contractor shall on that account have no claim against the Owner other than for an extension of time.

1.33 FINAL GUARANTEE

A. The Contractor shall guarantee all work for 1 year from the date of Final Acceptance of the Work by the Owner.

B. If, within the guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Engineer, are rendered necessary as the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall do the following promptly upon receipt of notice from the Owner and without expense to the Owner:

1. Place in satisfactory condition in every way all such guaranteed work and correct all defects in the guaranteed work.
2. Make good all damage to the building or site, or equipment or piping, or their contents, which, in the opinion of the Engineer, is the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract.
3. Make good any work or material or the equipment and contents of the building, structure, or site disturbed in fulfilling any such guarantee.

C. If the Contractor, after notice, fails to proceed to comply with the terms of this guarantee within 10 days, the Owner may have the defects corrected and the Contractor and his surety shall be liable for all expenses incurred provided. However, that in case of an emergency where, in the opinion of the Owner, delay would cause loss or damage, repairs may be started without notice being given to the Contractor and the Contractor shall pay the cost of such repairs.

D. All special guarantees or warranties applicable to specific parts of the Work as may be stipulated in the Contract Specifications or other papers forming a part of this Contract shall be subject to the terms of this Paragraph during the first year of life of each such guarantee. The Contractor shall assemble all special guarantees and manufacturers' warranties, along with a summary list of the special guarantees and warranties, and deliver these to the Engineer before the Work is accepted.

1.34 AUTOMATICALLY CONTROLLED EQUIPMENT

A. Whenever batching or mixing plant equipment is required to be operated automatically under the Contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for 48 hours after the breakdown or malfunction, provided this method of operation will produce results otherwise meeting the Specifications.

1.35 EQUIPMENT DATA FORMS

A. The Contractor shall obtain, prepare, and submit a complete, detailed listing of equipment and motor data for all electrical items furnished under this Contract. This listing shall be submitted with the preliminary draft of Operations and Maintenance Data Manuals on Equipment Data sheets and the Equipment Manufacturer's Certificate of Installation, Testing, and Instruction and the Manufacturer's Certificate of Compliance forms, which are included at the end of Section 11000, General Equipment Requirements.

1.36 RIGHTS IN AND USE OF MATERIALS FOUND ON THE WORK

A. With the Engineer's approval, the Contractor may use on the project such stone, gravel, sand, or other material determined suitable by the Engineer as may be found in the excavation. The Contractor shall replace at his own expense, with other acceptable material, all of that portion of the excavation materials so removed and used that were needed for use in the embankments, backfills, approaches, or otherwise. No charge for the materials used will be made against the Contractor.

1.37 OWNER-FURNISHED MATERIAL

A. The Contractor shall furnish all materials required to complete the Work. No materials will be furnished by the Owner.

1.38 MAINTENANCE AND LUBRICATION SCHEDULES

A. The Contractor's attention is directed to Section 01830, Operations and Maintenance Manuals, for requirements relative to the submittal of operating and maintenance data for the mechanical equipment. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name, address, and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

1.39 INSTALLATION LISTS

A. All manufacturers or equipment suppliers who propose to furnish equipment or products under Divisions 11, Equipment; 15, Mechanical; and 16, Electrical; shall submit an installation list to the Engineer along with the required Shop Drawings.

B. The installation list shall include all installation where identical equipment has been installed and has been in operation for at least 1 year.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01450
TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor will pay for the costs of all laboratory tests required to determine items such as soil density, concrete/grout compressive strength, and other testing, where appropriate, to determine compliance with the Contract Documents. All required testing shall be coordinated and scheduled by the Contractor.

1. The Contractor shall cooperate with the laboratory to facilitate the execution of required services.
2. The Owner shall approve the selection of the testing laboratory.
3. Employment of a testing laboratory shall in no way relieve the Contractor of the obligation to perform work in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders, or approvals of public authorities.

B. Respective Sections

1. Certification of products.
2. Laboratory tests required and standards for testing.

C. Each Section listed: Laboratory tests required and standards for testing.

D. Testing laboratory inspection, sampling, and testing are required for but are not limited to the following:

1. Article IV, Sections 201, 304, 307, 405, 506, and all other sections referencing testing laboratory services in the City of Clearwater Standard Technical Specifications.

1.03 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Submit to the Engineer for review a list and schedule of all tests to be conducted.

C. Describe test procedures along with the duration of tests.

D. After each inspection and test, the Laboratory shall promptly submit two copies of the laboratory report to the Engineer, one copy to the Contractor, and one copy to the Owner.

E. Include the following:

1. Date issued.
2. Project title and number.
3. Name of field testing technician or inspector.
4. Date and time of sampling or inspection.
5. Identification of product and Specifications Section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of test.
10. Conformance with Contract Documents.

F. When requested by the Engineer, provide interpretation of test results.

1.04 QUALITY ASSURANCE

A. The Laboratory is not authorized to do any of the following:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Engineer of Record or the Engineer.

B. The Contractor shall be responsible for the following:

1. Cooperating with laboratory personnel, providing access to work and to manufacturer's operations.

2. Securing and delivering to the laboratory adequate quantities of representative samples of materials proposed to be used and that require testing.

3. Providing to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes that require control by the testing laboratory.

4. Furnishing incidental labor and facilities:

   a. To provide access to Work to be tested.
   b. To obtain and handle samples at the project site or at the source of the product to be tested.
   c. To facilitate inspections and tests.
   d. To store and cure test samples.

5. Notifying the Engineer and laboratory sufficiently in advance of operations to allow the laboratory time to assign personnel and schedule tests.

6. Employing and paying for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling, and testing required for the Equipment Supplier or Contractor's (as applicable) convenience.

C. Materials and equipment used in the performance of Work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard requirements for quality and workmanship are indicated in the Contract Documents. The Engineer may require the equipment supplier or Contractor (as applicable) to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the Owner shall be allowed on account of such testing and certification.

D. If the test and any subsequent retest results indicate that the materials or equipment fail to meet the requirements of the Contract Documents, the equipment supplier or Contractor (as applicable) shall pay for the laboratory costs directly to the testing firm and these will not be reimbursable to the equipment supplier or Contractor (as applicable).

1.05 QUALIFICATIONS

A. Laboratory: Licensed to operate in Florida.

B. Laboratory Staff: Maintain a full-time Florida-registered Professional Engineer on staff to review the services performed under this project.

C. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards (NBS) or accepted values of natural physical constants.

D. Provide qualified personnel at the site. Cooperate with the Engineer and Contractor in performing services.

E. Perform specified inspection, sampling, and testing of products in accordance with specified standards.

F. Ascertain compliance of materials and mixes with requirements of Contract Documents.

G. Promptly notify the Engineer and Contractor of observed irregularities or non-conformance of Work or Products.

H. Perform additional inspections and tests required by Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 RESPONSIBILITY

A. This Section specifies the minimum requirements for temporary facilities, utilities, and controls required to provide an adequate and safe work site at every stage during construction of the Project. The Contractor is solely responsible for the requirements set forth in this Section.

1.02 ONSITE TEMPORARY

A. Except as otherwise indicated, the Contractor may, at his option, furnish stand-alone utility plants to provide needed services in lieu of connected services from available public utilities, provided such stand-alone plant facilities comply with all governing regulations. Before availability of temporary utility services, the Contractor will provide trucked-in/trucked-out containerized or unitized services for start-up of construction operations at the site.

1.03 COSTS

A. Except as otherwise indicated, the costs of providing and using temporary utility services are included in the contract sum.

1.04 TEMPORARY FACILITIES

A. The types of utility services required for temporary use at the project site include the following (other specific services may be required for specific construction methods of operations):

1. Electrical Power Service.
2. Sanitary.
3. Gas (fuel) Service.

1.05 TEMPORARY ELECTRICITY

A. The Contractor shall make the necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for proper completion of the Work and during its entire progress up to time of final acceptance by the Owner. The Contractor shall provide and pay for all temporary switches, connections, and meters.

1.06 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required or approved.

1.07 CLEANLINESS OF FACILITIES

A. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or on adjacent property.

1.08 TERMINATION AND REMOVAL

A. At the time the need for a temporary utility service has ended or has been replaced by use of permanent services, or no later than the time of final completion, the Contractor shall promptly remove the installation unless requested by the Engineer to retain it for a longer period. Any work that may have been delayed or affected by the installation and use of the temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces, shall be completed at this time. The Contractor shall replace any work damaged beyond acceptable restoration.

1.09 NOISE CONTROL

A. The Contractor shall provide adequate protection against objectionable noise levels caused by the operation of construction equipment.

1.10 DUST CONTROL

A. The Contractor shall provide for adequate protection against raising objectionable dust clouds caused by moving construction equipment, high winds, or any other cause.

1.11 WATER CONTROL

A. The Contractor shall provide for satisfactory disposal of surplus water and shall submit a plan to the Engineer for review before initiating and implementing the

plan. Approval shall be obtained from the proper authorities before the use of public or private lands or facilities for such disposal.

1.12 POLLUTION CONTROL

A. The Contractor shall provide for adequate protection against polluting any public or private lands, lakes, ponds, rivers, streams, creeks, and other such areas by the disposal of surplus material in the form of solids, liquids, gases, or from any other cause.

1.13 ADVERSE IMPACT

A. The Contractor shall evaluate and assess the impact of any adverse effects on the natural environment that may result from construction operations and shall operate to minimize pollution of air, ground, or surface waters vegetation, and afford the neighboring community the maximum protection during and up to completion of the construction project.

1.14 STREAMS, LAKES, AND OTHER BODIES OF WATER

A. The Contractor shall take sufficient precautions to prevent pollution of streams, lakes, and reservoirs with fuels, oils, bitumens, calcium chloride, or other harmful materials. He shall conduct and schedule his operations to avoid or otherwise prevent pollution of siltation of streams, lakes, and reservoirs and to avoid interference with the movements of migratory fish.

1.15 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

1.16 EROSION CONTROL

A. The Contractor shall not expose by construction operations a larger area of erosive land at any one time than the minimum necessary for efficient construction operations, and the duration of exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion-control features shall be constructed concurrently with other work and at the earliest practicable time.

1.17 STORAGE FACILITIES

A. All products, materials, and equipment shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible. Products subject to damage by the elements shall be stored in weathertight enclosures. Temperature and humidity shall be maintained within the ranges required by the manufacturer's instructions. Fabricated products shall be stored above the ground on blocking or skids. Products that are subject to deterioration shall be covered with impervious coatings with adequate ventilation to avoid condensation. Loose granular materials shall be stored in a well-drained area on solid surfaces to prevent mixing with foreign matter. Any products that will come in contact with water shall be stored off the ground to prevent contamination.

1.18 INSPECTION

A. Storage shall be arranged in such a manner to provide easy access for inspection. Periodic inspections shall be made of all stored products to ensure that they are maintained under specified conditions and free from damage or deterioration.

1.19 TEMPORARY PROTECTION

A. After installation, the Contractor shall provide substantial coverings as necessary to installed products to protect them from damage from traffic and subsequent construction operations. Coverings shall be removed when no longer needed.

1.20 ADJACENT TO WORK

A. The Contractor shall protect from damage all property along the line of the Work or in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Wherever such property is damaged due to the activities of the Contractor, it shall be immediately restored to its original condition by the Contractor at no cost to the Owner.

1.21 REMEDY BY OWNER

A. In case of failure on the part of the Contractor to restore such property or make good such damage or injury, the Owner may, after 48 hours’ notice to the Contractor, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost of such repairs, rebuilding, or restoration will be deducted from any monies due or which may become due to the Contractor under this Contract.

1.22 PROTECTION FROM DAMAGE

A. The Contractor shall be responsible for protecting property in the areas in the vicinity of the Project and for protecting his equipment, supplies, materials, and work against any damage resulting from the elements, such as flooding, rainstorm, wind damage, or other such damage, and shall be responsible for damage resulting from the same. The Contractor shall provide adequate drainage facilities, tie-downs, or other protection throughout the contract period for the protection of his, the Owner's, and other properties from such damage.

1.23 TRAFFIC REGULATION

A. Signs, marking barricades, and procedures shall conform to the requirements of the Florida Department of Transportation Manual on Traffic Controls and Safe Practices for Street and Highway Construction, Maintenance, and Utility Operations.

1.24 SIGNAGE

A. The Contractor shall provide and maintain adequate barricades around open excavations.

1.25 REMOVAL OF SIGNAGE

A. On completion of the Work, the Contractor shall remove all debris, excess materials, barricades, and temporary work, leaving walkways and roads clear of obstructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

This Section includes the minimum requirements for the furnished materials and equipment for this project. The more stringent requirements in the Technical Specification Sections shall take precedence over these requirements for any conflicts.

A. Materials and equipment furnished by the Contractor shall be new and shall not have been in service at any other installation unless otherwise approved. They shall conform to applicable specifications approved in writing by the Engineer.

B. Manufactured and fabricated products shall be designed, fabricated, and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gauges so as to be interchangeable.

C. Quantities of items that are identical shall be by the same manufacturer, regardless of the Design Package breakdown.

D. Equipment sizes, capacities, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

E. Materials and equipment shall not be used for any purpose other than that for which they are designed or specified.

F. Where materials or equipment are specifically shown or specified to be reused in the Work, special care shall be used in removing, handling, storing, and reinstalling to ensure their proper function in the completed Work.

G. Material and equipment incorporated into the Work:

1. Shall conform to applicable specifications and standards.

2. Shall comply with size, make, type, and quality specified or as specifically approved in writing by the Engineer.

3. Manufactured and fabricated products:

a. Rotating machinery shall be designed and fabricated to provide satisfactory operation without excessive wear and without excessive maintenance during its operating life. Rotating parts shall be statically and dynamically balanced and shall operate without excessive vibration.

1.02 ACCEPTANCE OF MATERIAL AND EQUIPMENT

A. Only new materials and equipment shall be incorporated in the Work. All materials and equipment furnished by the Contractor shall be subject to the inspection and acceptance of the Engineer. No material shall be delivered to the site that does not meet the Contract Specifications.

B. The Contractor shall submit data and samples sufficiently early to permit consideration and acceptance before materials are necessary for incorporating in the work. Any delay of acceptance resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner.

C. The materials and equipment used in the Work shall correspond to the approved samples or other data.

D. If requested, the Contractor shall be required to submit to the Engineer ample evidence that each and every part of the materials, machinery, and equipment to be furnished is of a reliable make and of a type that has been in successful operation within the continental United States. No equipment will be considered unless the manufacturer has designed and manufactured equipment of a comparable type and size for at least 3 years. The Owner will not allow any experimental or untried type of material or machinery to be installed.

E. The equipment specified shall be carefully designed and installed to ensure that it adequately performs all required functions within the specified degree of precision. Each unit shall operate with each of the other parts of the equipment to provide a completely integrated system that shall operate to the satisfaction of the Owner.

F. All equipment, machinery, parts, and assemblies of equipment, machinery, or parts entering into the Work shall be tested as specified. Unless waived in writing by the Engineer, all field and operating tests shall be made in the presence of the Engineer or the Engineer's authorized representative. When such a waiver is issued, the Contractor or manufacturer shall furnish sworn statements in duplicate of the tests conducted and the results of the tests to the Engineer.

G. The Contractor shall submit copies of welding procedures for all welding. Welders and welding operators shall be selected in accordance with the qualification requirements of the AWS Code. Welders and welding operators for stainless steel shall pass qualification tests using stainless steel filler metal and procedures developed for stainless steel. Procedures, welder, and operator qualifications shall be certified by an independent testing laboratory retained and paid by the Contractor.

H. The Contractor shall not start fabrication of the Work until the Contractor receives written acceptance of the proof of welding procedures from the Owner for each type of weld.

I. The Contractor shall submit copies of mill certificate for each type of rolled steel and as required in the Specifications. The Contractor shall not start fabrication of the work until the Contractor receives written acceptance of all mill certificates from the Owner.

1.03 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

A. The equipment installation details shall suit the existing and furnished equipment and are subject to acceptance by the Owner.

B. Any changes or revisions made necessary by the type and dimensions of the equipment furnished shall be made at the expense of the Contractor who shall furnish detailed drawings showing such changes or revision for the acceptance of the Owner.

C. The installation of all work shall comply with the manufacturer’s printed instructions. The Contractor shall obtain and distribute copies of such instructions to parties involved in the installation, including six copies to the Engineer for distribution. One complete set of instructions shall be maintained at the job site during installation and until the Project is complete.

D. All products and equipment shall be handled, installed, connected, cleaned, conditioned, and adjusted in accordance with the manufacturer’s instructions and specified requirements. Should job conditions or specified requirements conflict with the manufacturer’s instructions, such conflicts shall be called to the Owner’s attention for resolution and revised instructions.

E. The Contractor shall perform work according to the manufacturer's instructions and not omit any preparatory step or installation procedure unless the instructions are specifically modified or the step or procedure exempted by the Contract Documents.

1.04 INSTALLATION OF EQUIPMENT

A. General: The Contractor shall install the equipment in accordance with the manufacturer's instructions and recommendations and approved submittals at the locations shown on the Drawings. If the equipment locations shown on the Drawings are in conflict with the manufacturer's recommendations or will interfere with the installation or operation of any other item indicated in the Contract Documents, the Contractor shall relocate this equipment and provide the necessary appurtenances to install the equipment in accordance with the manufacturer's recommendations at no additional cost to the Owner. The Contractor shall not install any equipment at locations not in accordance with the Contract Documents or approved submittals.

B. The Contractor shall take special care to ensure proper alignment of all equipment including water control gates, pumping stations, water control structures, and appurtenances. The units shall be carefully aligned on their foundations by qualified millwrights after the units' sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the Manufacturer's Representative has approved the foundation alignments, the bedplates or wing feet of the equipment shall be securely bolted in place. The Contractor shall further check the alignment of the equipment after it is secured to the foundations and, after all alignments are confirmed, shall finally grout the sole plates in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping and under no circumstances will "pipe springing" be allowed.

C. The Contractor shall install equipment, slabs, walls level and plumb, parallel, and perpendicular to other building and components in exposed interior spaces, unless otherwise shown on the Drawings.

D. The Contractor shall apply an anti-seize compound to threaded fasteners of equipment components that require removal, replacement, or adjustment as part of any maintenance or inspection procedure.

E. The Contractor shall furnish and install the required oil and grease for initial operation in accordance with the manufacturer's recommendations.

F. The Contractor shall provide means of oil lubrication for bearings and other metallic parts in sliding contact. Use alemite industrial-type fittings except where otherwise specified. The Contractor shall also perform the following work:

1. Locate lubrication points on equipment readily accessible without the necessity of removing covers, plates, housings, or guards, or without creating safety hazards at installed equipment elevations.
2. Exhaust pressure-lubricated units to the atmosphere to prevent excessive greasing.
3. Extend grease fittings to locations that are readily accessible to the Owner. The Contractor shall coordinate the location of these grease fittings with the Owner before their installation.

G. The Contractor shall furnish and apply touch-up paint to any equipment's factory painting finish that is chipped or damaged during installation. All factory-finish touch-up paint shall be mutually compatible with the factory finish on the equipment and shall be furnished by the manufacturer of the equipment to be touched up in the field.

H. If equipment mounting heights are not shown on the Drawings, the Contractor shall install that piece of equipment to provide the maximum amount of headroom (defined as the distance from the bottom of the structure to the top of finished floor or grade) as possible. In such an instance, the Contractor shall obtain the Owner's approval for this mounting location before installing that piece of equipment in the field.

I. The Contractor shall furnish and install all mechanical equipment to facilitate service, maintenance, and repair or replacement of the equipment components. The Contractor shall connect equipment for ease of disconnecting, with minimum interference to other installations.

J. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted before Substantial Completion.

K. The Contractor shall furnish the service of competent manufacturers' representatives for Contractor- or Owner-furnished equipment when evident malfunction or over-heating makes such services necessary or as determined by the Owner. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.

L. The Contractor shall furnish all wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level, and secure an

apparatus in place. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper alignment after erection shall be done at the expense of the Contractor.

M. The Contractor shall furnish the necessary materials and construct suitable concrete foundations or pads for all equipment installed by the Contractor, even though such foundations or pads may not be indicated on the Drawings. The tops of foundations shall be at such elevations as will permit grouting.

1.05 LUBRICATION SYSTEM

A. The minimum design criteria for lubricating moving parts of the equipment shall include 1 week of continuous operation during which no lubricants shall be added to the system.

B. The system shall be designed to receive lubricants whether in operation or shut down and shall not leak or waste lubricants under either condition. The manufacturer's recommendations of grade and quality and a supply of the lubricants so recommended in quantities sufficient to conduct start-up and testing operations shall be furnished with the equipment.

1.06 SPECIAL TOOLS

A. Manufacturers of equipment and machinery shall furnish two sets of any special tools (including grease guns or other lubricating devices) required for normal adjustment, operations and maintenance, and disassembly, together with instructions for their use. The Contractor shall preserve and deliver to the Owner these tools and instructions in good order before completing the Contract. Tools shall be high-grade, smooth, forged, alloy tool steel. Grease guns shall be lever-type.

B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.

C. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to the Owner.

1.07 TESTS AND TEST REPORTS

A. When used in the Contract Documents, "Factory/Fabricating Shop Performance, Evaluation, Certification, and/or Acceptance Tests and Test Reports" shall be considered to mean the corresponding manufacturer’s, fabricator’s, and/or other builder’s official tests and test reports. Included in these test reports shall be

appropriate substantiating documentation/data ascertaining the correct and complete manufacture, fabrication, and "shop performance" (to the greatest extent normally practicable) of the particular material, equipment, system, and/or facilities proposed for eventual delivery. These are subdivided into three significant tests and test report types: 1) Certification Tests and Test Reports, 2) Factory Tests and Test Reports, and 3) Shop Performance/Evaluation Tests and Test Reports. Minimal requirements are described below.

B. Certification Tests and Test Reports

1. Standard specifications, code references, etc. for minimum quality and workmanship levels are indicated in the Contract Documents and Construction Documents. Statements, certificates, and other substantiating reporting data, called "Certification Test Reports" in this Section, of tests conducted on previously manufactured materials or equipment identical to that proposed for use shall be compiled by the Contractor.
2. At a minimum all Certification Test Reports shall contain an official analysis of sufficient material composition or show evidence of meeting or exceeding the specified material standard(s) referenced, e.g., ASTM, ASME, or other designations. All reports shall also indicate from whom the material was/will be purchased.
3. The Contractor shall pay all costs of certification tests and test reports.

C. Factory Tests and Test Reports

1. Additional tests and reports performed on material or equipment by the manufacturer or fabricator to ascertain quality or workmanship are referred to here as "Factory Tests and Test Reports."
2. Before the delivery of any Factory Test Report, the Contractor shall first submit for review and approval a detailed description of the proposed testing, including reporting procedure and criteria. Such descriptions shall also be delivered to the Owner for review as part of the first submission of the technical submittal.
3. Materials and equipment used in the performance of the Work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. If Work to be accomplished away from the construction site is to be inspected on behalf of the Owner during its fabrication or manufacture, the Contractor shall give prior notice to the Engineer of the place and time where such fabrication or manufacture is to be done. Such notice shall be in writing and delivered to the Engineer not less than 30 days before the Work is to be done so that the necessary arrangements for the particular factory inspection tests can be made.
4. Upon completion of the factory inspection tests and immediately following manufacture or fabrication, the Contractor shall compile a

complete Factory Test Report following the approved format above. All such reports shall be delivered to the Owner for review as part of the technical submittal corresponding to such tested material or equipment.

D. Shop Performance/Evaluation Tests and Tests Reports

1. Material and equipment used in the performance of the Work of this Contract are also subject to evaluation and testing after the complete full-scale assembly into major equipment and/or systems. Shop Performance/Evaluation Tests, i.e., tests of simulated startup, steady-state, variable loading, and other normal operating conditions, for such assembled equipment/systems shall be accomplished in strict accordance with the standard testing practices specified or otherwise accepted by the Engineer.
2. Before the delivery of any Shop Performance/Evaluation Test Report, the Contractor shall submit for review a detailed description of the proposed performance/evaluation tests, including anticipated reporting procedures, data reduction, and criteria used. Where appropriate, such descriptions shall also be delivered to the Engineer for review as part of a first or subsequent submission of the technical submittal.
3. Should such performance/evaluation tests be accomplished away from the construction site, the Contractor shall give prior notice to the Owner of the places and times where such tests will be accomplished. Such prior notice shall be in writing and delivered not less than 30 days before such events so that necessary arrangements for the particular tests can be made.
4. The requirements above pertaining to Factory Tests and Test Reports shall be incorporated for shop Performance/Evaluation Tests and Test Reports. Unless factory tests are coincident with shop performance tests and vice versa for the same material or equipment, a minimum of 15 days shall be scheduled between such multiple equipment tests where extended travel is required.

E. Cost of Performance Shop Tests

1. The Contractor shall conduct shop performance full-scale tests at its expense on all equipment as specified. Each piece of equipment shall be tested completely assembled and the shop tests performed by the equipment manufacturer until successful tests are achieved.
2. If the performance tests are conducted outside the continental United States, the Contractor shall pay all transportation expenses incurred by the Owner’s representatives in witnessing the tests at no additional cost to the Owner.

1.08 FIELD TESTING

A. Field-testing shall be conducted when called for in the Technical Specification Sections and on all completed systems in general. The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and startup tests as specified in the Division 11 Specifications. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Owner approves their use for this project. The Contractor shall refer to the Division 11 Specifications regarding equipment shop testing requirements.

B. After completing the installation, the Contractor shall test the system in the presence of the Owner and under actual operating conditions. Tests shall be performed according to the manufacturer's recommendations.

C. The Contractor shall include with its bid the services of the equipment manufacturer's field service technician for a period necessary to complete the Work to the satisfaction of the Engineer and the Owner.

D. This service shall be for the purposes of checkout, initial start-up, certification, and instruction of facilities personnel.

E. A written report covering the technician's findings and installation approval shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

1.09 ACCEPTANCE OF INSTALLATION

A. The Engineer may accept an equipment system installation as ready for Substantial Completion when:

1. The Engineer has accepted all factory tests and all other component testing.
2. The Engineer has accepted all performance shop tests.
3. All components of the system are installed and tested, including without limitation hydrostatic tests, leak tests, continuity tests, insulation resistance tests, phase rotation tests, bump tests, stroke testing, calibration, adjustment for proper operation, and all other component tests as appropriate.
4. Field start-up activities have been completed and approved by the Engineer.
5. The appropriate certificates have been submitted.
6. All equipment has met the performance requirements.

7. The Engineer has accepted integrated system tests and adjustments performed by the Contractor to demonstrate that the system as a whole functions reliably and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component or of the system as a whole.
8. The Engineer has accepted integrated facilities tests performed by the Contractor to demonstrate that the entire Construction functions together reliably as an integrated facility and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component.
9. The Engineer has accepted facilities performance tests which demonstrate that the design criteria and performance criteria are met.
10. The Engineer has accepted the O&M Manuals.
11. All required Owner personnel have been trained.
12. All other Contract requirements for Substantial Completion have been satisfied.

1.10 GREASE, OIL, AND FUEL

A. All grease, oil, and fuel required for start-up and testing of equipment shall be furnished with the respective equipment.

B. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of mechanical equipment no greater than 30 days after initial break-in of the equipment.

1.11 ELECTRICAL EQUIPMENT ENCLOSURES

A. All items of electrical equipment that are furnished with process, heating, ventilating, or other equipment shall conform to the requirements specified under the appropriate Electrical Sections of the Specifications. Enclosures for electrical equipment, such as switches and starters, shall conform to the requirements specified under the appropriate Electrical Sections of the Specifications.

1.12 EQUIPMENT DRIVE GUARDS

A. Screens, guards, or cages shall be provided for all exposed rotating or moving parts in accordance with accepted practices of applicable governmental agencies. Unless specified otherwise in the Technical Specifications Sections, guards shall be constructed of galvanized sheet steel or galvanized woven wires or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps that will permit easy removal for servicing the equipment.

1.13 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous-impregnated felt, heavy -bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

1.14 CONCRETE INSERTS

A. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.

1.15 SLEEVES AND OPENINGS

A. The Contractor shall provide all openings, channels, chases, etc., in new construction and furnish and install anchor bolts and other items to be embedded in concrete, as required to complete the Work under this Contract. The Contractor shall perform all cutting, coring, and rough and finish patching required in existing construction for the work of all trades.

B. Subcontractors shall furnish all sleeves, inserts, hangers, anchor bolts, etc., required for the execution of their work. Before the work of the Contractor begins, the subcontractors shall be responsible for furnishing the Contractor with the above items and with templates, drawings, or written information covering chases, openings, etc., which they require and to follow up the work of the Contractor as it progresses, making sure that their drawings and written instructions are carried out. If the subcontractors fail to do this, they shall be responsible for the cost of any corrective measures that may be required to provide necessary openings, etc. If the Contractor fails to carry out the directions given him, covering details and locations of openings, etc., he/she shall be responsible for any cutting and refinishing required to make the necessary corrections. In no case shall beams, lintels, or other structural members be cut without the approval of the Owner.

C. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, galvanized-steel pipe. Each sleeve shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of the slabs and to

project 2 inches above the finished floor surface. Threaded nipples shall not be used as sleeves.

D. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2-inch annular fin of 1/4-inch plate welded with a continuous weld completely around the sleeve at about mid-length. Sleeves shall be galvanized after the fins are attached.

E. All sleeves shall be set accurately before the concrete is placed or shall be built-in accurately as the masonry is being built.

1.16 SERVICES OF MANUFACTURERS' FIELD SERVICE TECHNICIAN

A. Bid prices of equipment furnished shall include the cost of a competent field service technician of the manufacturers of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance as specified in Section 11000, General Equipment Requirements. The approved manufacturer's operation and maintenance data as specified in Section 01830, Operations and Maintenance Manuals, shall be delivered to the Owner before instructing the Owner's personnel. This supervision may be divided into two or more periods as required by the installation program or as directed by the Owner.

B. After the equipment has been installed and the equipment is presumably ready for operation, but before it is operated by others, the manufacturers' field service technician shall inspect, operate, test, and adjust the equipment. The inspection shall include at least the following points where applicable:

1. Soundness (without cracked or otherwise damaged parts).
2. Completeness in all details, as specified and required.
3. Correctness of setting, alignment, and relative arrangement of various parts.
4. Adequacy and correctness of packing, sealing, and lubricants.
5. Calibration and adjustment of all related instrumentation and controls.
6. Energize equipment.
7. Deficiency correction.
8. Demonstration of compliance with application performance specification.

C. The operation, testing, and adjustment shall be as required to prove that the equipment has been left in proper condition for satisfactory operation under the conditions specified.

D. Upon completion of this operation, testing, and adjustment, the manufacturers' field service technician shall submit to the Owner, in triplicate, a complete, signed

report of the results of the inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance.

E. Each equipment manufacturer shall provide instruction to the Owner's operating personnel. Training shall not be performed until the requirements of Paragraphs B, C, and D above have been fully satisfied and any specified performance testing completed. Training shall be provided for the number of days specified in each Equipment Section of these Specifications. Training shall be provided on an 8-hour-per-day basis. Partial days (less than 8 full working hours) shall not be credited toward the specified durations. Training shall not be concurrent with on-going testing, debugging, or installation activities but shall be a separate activity devoted exclusively to the instruction of the Owner's personnel in the operation and maintenance of the manufacturers' equipment. Training shall be performed by qualified representatives of each equipment manufacturer specifically skilled in providing instruction to operation personnel. Training shall provide an overview of operations and maintenance requirements and shall include but not be limited to the following:

1. Description of unit and component parts.
2. Operating capabilities and performance criteria.
3. Operating procedures.
4. Maintenance procedures.
5. Servicing and lubrication schedules.
6. Troubleshooting.

F. A certificate from the manufacturer stating that the installation of the equipment is satisfactory; that the unit has been satisfactorily tested and is ready for operation; and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted before start-up and acceptance by the Owner. The certificate shall indicate date and time the instruction was given and names of the operating personnel in attendance.

G. See the detailed Specifications for additional requirements for furnishing the services of the manufacturers' field service technician.

H. For equipment furnished, the Contractor, unless otherwise specified, shall furnish the services of accredited field service technicians of the manufacturer only when some evident malfunction or over-heating makes such services necessary in the opinion of the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01650
DELIVERY, STORAGE, AND HANDLING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the general requirements for the delivery, handling, storage, and protection of all items required in the construction of the Work. Specific requirements, if any, are specified with the related item.

1.02 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in this Section for storing and protecting the items.

B. The Contractor shall do the following:

1. Materials and equipment shall be loaded and unloaded by methods affording adequate protection against damage. Every precaution shall be taken to prevent injury to the material or equipment during transportation and handling. Suitable power equipment shall be used and the material or equipment shall be under control at all times. Under no condition shall the material or equipment be dropped, bumped, or dragged. When a crane is used, a suitable hook or lift sling shall be used. The crane shall be so placed that all lifting is done in a vertical plane. Materials or equipment skid loaded, palletized, or handled on skidways shall not be skidded or rolled against material or equipment already unloaded.

2. Material and equipment shall be delivered to the job site by means that will adequately support it and not subject it to undue stresses. Material and equipment damaged or injured in the process of transportation unloading or handling shall be rejected and immediately removed from the site.

3. The Contractor shall coordinate the delivery of all materials, including those furnished by the Owner. The Contractor shall be responsible for the proper transport, handling, and storing of all materials, and materials shall be protected to ensure their expected performance. Delivery schedules shall be coordinated by the Contractor, in advance, so that the Work will be done in a timely manner.

4. The Contractor shall coordinate deliveries of products with construction schedules to avoid conflict with work and conditions at the site. The Contractor shall also do the following:

    a. Deliver products in undamaged condition, in the manufacturer's original containers or packaging, with identifying labels intact and legible.
    b. Immediately on delivery, inspect shipments to ensure compliance with requirements of the Contract Documents and approved submittals and to ensure that the products are properly protected and undamaged.

5. The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

6. All materials and equipment shall be stored on-site in complete compliance with the manufacturer’s recommendations.

7. Store products subject to damage by the elements in weather-tight enclosures.

8. Maintain temperature and humidity within the ranges required by the manufacturer's instructions.

9. Store fabricated products above the ground, on blocking or skids to prevent soiling or staining. Cover products that are subject to deterioration with impervious sheet coverings, and provide adequate ventilation to avoid condensation.

10. All materials and equipment to be incorporated in the Work shall be handled and stored by the Contractor before, during, and after shipment in a manner that will prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft, or damage of any kind to the material or equipment.

11. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the Work, and the Contractor shall receive no compensation for the damaged material or its removal.

12. The Contractor shall arrange storage in a manner to provide easy access for inspection and make periodic inspections of stored products to ensure that products are maintained under specified conditions, free from damage or deterioration.

13. The Contractor shall provide substantial coverings as necessary to protect installed products from traffic damage and subsequent construction operations and shall remove these coverings when they are no longer needed.

14. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract, within 7 days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in the previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may include expenditures for labor, equipment use, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.

15. Schedule delivery to reduce long-term onsite storage before installation and/or operation. Under no circumstances shall equipment be delivered to the site more than 1 month before installation without written authorization from the Engineer.

16. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.

17. Deliver products to the site in the manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting, and installing.

18. Unload and place all items delivered to the site in a manner which will not hamper normal construction operation nor that of subcontractors and other contractors and will not interfere with the flow of necessary traffic.

19. Provide necessary equipment and personnel to unload all items delivered to the site.

20. The Contractor shall store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Follow storage instructions, review them with the Engineer, and keep a written record of this. Arrange storage to permit access for inspection.

21. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

22. Store cement and lime under a roof and off the ground and keep it completely dry at all times. All structural, miscellaneous, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Handle and store brick, block, and similar masonry products in a manner to keep breaking, cracking, and spilling to a minimum.

23. Store all mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) in a weathertight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. The building shall be provided with adequate ventilation to prevent condensation. The Contractor shall ensure that temperature and humidity are maintained within the range required by the manufacturer.

    a. All equipment shall be stored fully lubricated with oil, grease, and other lubricants unless otherwise instructed by the manufacturer.
    b. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the Contractor shall start the equipment, at least at half load, once weekly for an adequate period to ensure that the equipment does not deteriorate from lack of use.
    c. Lubricants shall be changed when installation is complete and as frequently as required thereafter during the period between installation and acceptance. The Contractor shall put new lubricants into the equipment at the time of acceptance.
    d. Before accepting equipment that has been stored for some time, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested, and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01730
CUTTING, CORING, AND PATCHING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all cutting, coring, fitting, and patching, including attendant excavation and backfill, required to complete the Work or to accomplish the following:

1. Make the Work's several parts fit together properly.
2. Uncover portions of the Work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of Subcontract Documents.
5. Remove samples of installed work as specified for testing.
6. Provide routine penetrations of non-structural surfaces for installing piping and electrical conduit.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit a written request well in advance of executing any cutting or alteration that affects the following:

1. Work of the Owner or any other Contractor.
2. Structural value or integrity of any element of the Project.
3. The integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
4. The efficiency, operational life, maintenance, or safety of operational elements.
5. Visual qualities of elements exposed to view.

C. The written request shall include the following:

1. Identification of the Project.
2. Description of affected Work.
3. The necessity for cutting, altering, or excavating.

4. The effect on the work of the Owner or any other Contractor or on the structural or weatherproof integrity of the Project.
5. Description of proposed Work:

    a. Scope of cutting, patching, alteration, or excavation.
    b. Trades which will execute the Work.
    c. Products proposed to be used.
    d. Extent of refinishing to be done.

6. Alternatives to cutting and patching.
7. Cost proposal, when applicable.
8. Written permission of any other Contractor whose work will be affected.

D. The Contractor shall submit written notice to the Engineer designating the date and the time the Work will be uncovered.

1.03 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete and grout for rough patching shall be in accordance with the Drawings and as specified in Division 3 Section 03600.

B. Materials for finish patching shall be equal to those of adjacent construction.

PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering Work, the Contractor shall inspect conditions affecting installation of products or performance of the Work.

C. The Contractor shall report unsatisfactory or questionable conditions to the Engineer in writing and shall not proceed with work until the Engineer has provided further instructions.

D. All cutting and coring shall be performed in such a manner as to limit the extent of patching.

E. All holes cut through concrete and masonry walls, slabs, or arches shall be core-drilled unless otherwise approved. No structural members shall be cut without approval of the Engineer, and all such cutting shall be done in a manner directed by the Engineer. No holes shall be drilled in beams or other structural members without obtaining prior approval. All work shall be performed by mechanics skilled in this type of work.

F. Rough patching shall be such as to bring the cut or cored areas flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces as approved.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to ensure the structural value or integrity of the affected portion of the Work.

B. Provide devices and methods to protect other portions of the Project from damage.

C. Provide protection from elements for that portion of the Project that may be exposed by cutting and patching work and maintain excavations free from water.

D. Perform coring with an approved non-impact rotary tools with diamond core drills. The size of the holes shall be suitable for pipe, conduit, sleeves, and equipment or mechanical seals to be installed.

E. Ensure that all equipment conforms to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring, and maintenance.

F. Provide protection for existing equipment, utilities, and critical areas against water or other damage cause by drilling operation.

G. Following drilling, vacuum or otherwise remove from the area all slurry or tailings resulting from coring operations.

3.03 PERFORMANCE

A. Cut and demolish by methods that will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Excavate and backfill by methods which will prevent settlement or damage to other work.

C. Employ the original installer or fabricator to perform cutting and patching for the following:

1. Weather-exposed or moisture-resistant elements.
2. Sight-exposed finished surfaces.

D. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

E. Cut with a concrete wall saw and diamond saw blades of proper size.

F. Control slurry generated by sawing operation on both sides of wall.

G. When cutting a reinforced concrete wall, cut so as not to damage the bond between the concrete and reinforcing steel left in structure. Make the cut so that steel neither protrudes nor is recessed from the face of the cut.

H. Install adequate bracing of the area to be cut before cutting starts. Check the area during sawing operation for partial cracking and provide additional bracing as required to prevent a partial release of the cut area during sawing operations.

I. Provide equipment of adequate size to remove cut panel.

J. Restore work that has been cut or removed; install new products to provide completed work in accordance with requirements of Subcontract Documents.

K. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

L. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

1. For continuous surfaces, refinish to the nearest intersection.
2. For an assembly, refinish the entire unit.

M. Provide for Proper Pavement Restoration: The Contractor shall restore existing paving, including underdrains if any are encountered and broken into, and shall replace or rebuild the paving using the same type of construction as was in the original. The Contractor shall be responsible for restoring all such work, including subgrade and base courses where present. The Contractor shall obtain and bear the expense of such local or other governmental permits as may be necessary.

END OF SECTION

SECTION 01740
FINAL CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall execute cleaning during progress of the Work and at the completion of the Work as required by General Conditions.

1.02 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.03 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.04 ENVIRONMENTAL CONCERNS

A. Cleaning and disposal operations shall comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

The Contractor shall do the following:

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by the manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.

PART 3 EXECUTION

3.01 PERIODIC CLEANING

The Contractor shall do the following:

A. Execute periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris.

B. Provide on-site containers for the collection of waste materials, debris, and rubbish.

C. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal areas away from the site.

3.02 DUST CONTROL

The Contractor shall do the following:

A. Clean interior spaces before the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

3.03 FINAL CLEANING

The Contractor shall do the following:

A. Employ skilled workers for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from interior and exterior surfaces exposed to view.

C. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

D. Before final completion or Owner occupancy, inspect interior and exterior surfaces exposed to view and all work areas to verify that the entire Work is clean.

END OF SECTION

SECTION 01755
EQUIPMENT TESTING AND STARTUP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide a competent field services technician of the manufacturers of all equipment furnished under Divisions 11, Equipment, 15, Mechanical, and 16, Electrical, to supervise installation, adjustment, initial operation and testing, performance testing, final acceptance testing, and startup of the equipment.

B. The Contractor shall perform specified equipment field performance tests, final acceptance tests, and startup services.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit name, address, and résumé of proposed field services technicians at least 30 days in advance of the need for such services.

B. Submit for review detailed testing procedures for shop tests, field performance tests, and final acceptance tests as specified in the various Equipment Specification Sections. Test procedures shall be submitted at least 30 days in advance of the proposed test dates and shall include at least the following information:

1. Name of equipment to be tested, including reference to specification section number and title.
2. Testing schedule of proposed dates and times for testing.
3. Summary of power, lighting, chemical, water, sludge, gas, etc., needs and identification of who will provide them.
4. An outline of specific assignments of the responsibilities of the Contractor and manufacturers' factory representatives or field service personnel.
5. Detailed description of step-by-step testing requirements, with reference to appropriate standardized testing procedures and laboratory analyses by established technical organizations (e.g., ASTM, WPCF Standard Methods).
6. Samples of forms to be used to collect and record test data and to present tabulated test results.

C. Submit copies of test reports upon completion of specified shop, performance, and acceptance tests. Test reports shall incorporate the information provided in the test procedures submittals, modified to reflect the actual conducting of the tests and the following additional information:

1. Copies of all test data sheets and results of lab analyses.
2. Summary comparison of specified test and performance requirements vs. actual test results.
3. Should actual test results fail to meet specified test and performance requirements, a description of actions to be taken before re-testing the equipment.

D. Submit copies of the manufacturer's field service technician's report summarizing the results of the initial inspection, operation, adjustment, and pre-tests. The report shall include detailed descriptions and tabulations of the points inspected, tests and adjustments made, quantitative results obtained, suggestions for precautions to be taken to ensure proper maintenance, and the equipment supplier's Certificate of Installation in the format specified in this Section.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Water Works Association (AWWA)

1. AWWA C653—Disinfection of Water Treatment Plants.

B. American Society for Testing and Materials (ASTM)

C. Water Pollution Control Federation (WPCF)

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

A. Field service technicians shall be competent and experienced in the proper installation, adjustment, operation, testing, and startup of the equipment and systems being installed.

B. Manufacturers' sales and marketing personnel will not be accepted as field service technicians.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PRELIMINARY REQUIREMENTS

A. After the equipment has been installed and the equipment is presumably ready for operation but before it is operated by others, the manufacturer's field service technician shall inspect, operate, test, and adjust the equipment. The inspection shall include at least the following points where applicable:

1. Soundness (without cracks or otherwise damaged parts).
2. Completeness in all details, as specified and required.
3. Correctness of setting, alignment, and relative arrangement of various parts.
4. Adequacy and correctness of packing, sealing, and lubricants.

B. The operation, testing, and adjustment shall be as required to prove that the equipment has been left in proper condition for satisfactory operation under the conditions specified.

C. Upon completion of this work, the manufacturer's field service technician shall submit a signed report of the results of his/her inspection, operation, adjustments, and tests.

3.02 WITNESS REQUIREMENTS

A. Shop tests or factory tests may be witnessed by the Owner and/or the Owner's representatives, as required by the various equipment specifications.

B. Field performance and acceptance tests shall be performed in the presence of the Owner, the Owner's designated personnel, and/or the Owner's representatives.

3.03 STARTUP AND ACCEPTANCE OF THE TREATMENT PLANT AND RELATED SYSTEMS

A. General Requirements

1. Successfully execute the step-by-step procedure of startup and performance demonstration specified in this Section.

2. The startup and performance demonstration shall be successfully executed before Substantial Completion and acceptance by the Owner of the treatment plant and its related systems.
3. All performance tests and inspections shall be scheduled at least 5 working days in advance or as otherwise specified with the Owner and the Engineer. All performance tests and inspections shall be conducted during Monday through Friday, unless otherwise specified.

B. Preparation for Startup

1. All mechanical and electrical equipment shall be checked to ensure that it is in good working order and properly connected. Preliminary run-ins of the various pumps, compressors, and other remaining equipment shall be made. All systems shall be cleaned and purged as required. All sumps, tanks, basins, chambers, pump wells, and pipelines which are hydraulically checked shall be drained and returned to their original condition once the water testing is complete.
2. All instruments and controls shall be calibrated through their full range. All other adjustments required for proper operation of all instrumentation and control equipment shall be made.
3. The Contractor shall perform all other tasks needed for preparing and conditioning the treatment facilities for proper operation.
4. No testing shall be conducted or equipment operated until the Engineer has verified that all specified safety equipment has been installed and is in good working order.
5. No testing shall be conducted or equipment operated until the Engineer has verified that all lubricants, tools, maintenance equipment, spare parts, and approved equipment operation and maintenance manuals have been furnished as specified.

C. Facilities Startup

1. The startup period shall not begin until all newly constructed facilities and equipment have been tested as specified and are ready for operation. The Owner shall receive spare parts, safety equipment, tools and maintenance equipment, lubricants, approved operation and maintenance data, and the specified operation and maintenance instruction before the startup with waste water. All valves shall be tagged before this startup.

2. Demonstrate 7 consecutive 24-hour days of successful operation of the facility as a prerequisite of Substantial Completion and Acceptance.

3. If the facility fails to demonstrate satisfactory performance on the first or any subsequent attempt, the Contractor shall make all necessary

alterations, adjustments, repairs, and replacements. When the facility is again ready for operation, it shall be brought on line and a new test shall be started. This procedure shall be repeated as often as necessary until the facility has operated continuously to the satisfaction of the Owner and Engineer for the specified duration.

4. The Owner will furnish all operating personnel (other than vendor's or subcontractor's service personnel) needed to operate equipment during the final test period; however, these personnel will perform their duties under the Contractor's direct supervision. Until performance tests are completed and units and systems are accepted by the Owner as substantially complete, the Contractor shall be fully responsible for the operation and maintenance of all new facilities.

5. The Owner will provide all necessary water and electricity. However, the Contractor shall provide all necessary personnel of the various construction trades, i.e., electricians, plumbers, etc., and field service personnel of the major equipment suppliers on an 8-hour-per-day basis at the facilities and on a 24-hour-per-day basis locally during the startup period. Major equipment suppliers shall include but not be limited to the following:

    a. Telemetry, Instrumentation, and Control Equipment.
    b. Treatment Units.
    c. All Pumping Equipment.

6. At no time during startup shall the Contractor allow the facility to be operated in a manner that subjects equipment to conditions that are more severe than the maximum allowable operating conditions for which the equipment was designed.

END OF SECTION

SECTION 01770
PROJECT CLOSEOUT

PART 1 GENERAL

1.01 SUBSTANTIAL COMPLETION

A. When the Contractor considers that the Work or designated portion of the Work is Substantially Complete, the Contractor shall submit written notice to the Engineer with a list of items to be completed or corrected.

B. If the Engineer's review finds that the Work is not substantially complete, the Engineer will promptly notify the Contractor in writing, listing observed deficiencies.

C. The Contractor shall remedy deficiencies and send a second written notice of Substantial Completion.

D. When the Engineer finds the Work is Substantially Complete, the Engineer will prepare a Certificate of Substantial Completion.

1.02 FINAL COMPLETION

A. When the Contractor considers that the Work or designated period of the Work is complete, the Contractor shall submit written certification to the Engineer indicating the following:

1. The Contract Documents have been reviewed.
2. The Work has been reviewed for compliance with the Contract Documents.
3. The Work has been completed in accordance with the Contract Documents and deficiencies listed with Certificates of Substantial Completion have been corrected.
4. The Work is complete and ready for final inspection.
5. All required shop drawings, catalog cuts, operations and maintenance manuals, instruction manuals, test reports, samples, and all other submittals have been submitted and reviewed by the Engineer.
6. All deliverables have been delivered or placed as accepted by the Engineer.

B. If the Engineer's inspection reveals that the Work is incomplete, the Engineer will promptly notify the Contractor in writing listing observed deficiencies.

C. The Contractor shall remedy deficiencies and send a second certification of Final Completion.

D. When the Engineer finds that the Work is complete, the Engineer will consider closeout submittals.

1.03 ADDITIONAL REVIEW FEES

A. If the status of Completion of Work requires more than two reviews of the Work by the Engineer due to failure of the Work to comply with the Contractor's claims on the first and second reviews, the Owner will deduct from the final payment to the Contractor the amount of the Engineer’s compensation for additional review services.

1.04 CLOSEOUT SUBMITTALS

A. Evidence of Compliance with Requirements of Governing Authorities:

1. Certificate of Occupancy.
2. All required Certificates of Government Inspections.

B. Operation and Maintenance Manuals: Under provisions of Section 01830, Operations and Maintenance Manuals.

C. Evidence of Payment and Release of Liens: In accordance with Conditions of the Contract.

D. Consent of Surety to Final Payment.

1.05 STATEMENT OF ADJUSTMENT OF ACCOUNTS

A. Submit final statement reflecting adjustments to total Contract Price, indicating the following:

1. Original total Contract Price.
2. Previous change orders.
3. Changes under allowances.
4. Changes under unit prices.
5. Deductions for uncorrected Work.
6. Penalties and bonuses.
7. Deductions for liquidated damages.
8. Deductions for Engineer’s additional review fees.
9. Other adjustments to total Contract Price.
10. Total Contract Price as adjusted.

11. Previous payments.
12. Sum remaining due.

B. Upon the Owner's review and approval, the Engineer will issue a final Change Order reflecting approved adjustments to the total Contract Price not previously made by change orders.

1.06 APPLICATION FOR FINAL PAYMENT

A. Submit application for final payment in accordance with provisions of Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01780
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

A. Compile specified warranties and bonds.
B. Co-execute submittals when so specified.
C. Review submittals to verify compliance with Contract Documents.
D. Submit submittals to the Owner for review.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Assemble warranties, bonds, and service and maintenance contracts executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Number of original signed copies required: Two each.

C. Table of Contents: Neatly typed, in sequence of the Specifications. Provide completion information for each item as follows:

1. Product or work item.

2. Firm, address, telephone and fax numbers, and name and email of principal.

3. Scope.

4. Date of beginning of warranty, bond, or service and maintenance contract.

5. Duration of warranty, bond, or service and maintenance contract.

6. Provide information for Owner's personnel:

a. Proper procedure in case of failure.
b. Instances that might affect the validity of warranty or bond.

7. Contractor, with address, telephone and fax numbers, and the name and email of responsible principal.

D. Submittal of warranties, bonds, and service and maintenance contracts shall be included in submittals for review and before Final Completion with actual dates included.

E. The Contractor's obligation to correct defective or nonconforming Work shall run for 1 year (or such longer period may otherwise be specified in the Contract Documents) beginning from the date Substantial Completion is achieved.

1.03 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and this Section.

B. All mechanical and electrical equipment together with devices of whatever nature and all components which are furnished and/or installed by the Contractor shall be guaranteed.

C. The guarantee shall be against the manufacturing and/or design inadequacies, materials, and workmanship not in conformity, improper assembly, hidden damage, failure of devices and/or components, excessive leakage, or other circumstances which would cause the equipment to fail under normal design and/or specific operating conditions for 1 year or such longer period as may be shown and/or specified from and after the date of Substantial Completion.

D. The Contractor shall replace and install each piece of equipment, device, or component which shall fail within the term specified above of the guarantee with reasonable promptness without increase in the Contract Price. If the Contractor fails to provide timely repairs as specified in this Section, the Owner shall issue a claim against the Contractor's Bond. In some instances, if approved by the Owner, the Contractor may be allowed to repair the equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01815
MAINTENANCE OF PLANT OPERATION AND SEQUENCE OF CONSTRUCTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The existing water reclamation facility will be maintained in continuous operation by the Owner at all times during the entire construction period. The Contractor shall schedule and conduct his work such that it will not impede any treatment process, create potential hazards to operating equipment and/or personnel, reduce the quality of the plant effluent, result in any spills or leakage, or cause odor or other nuisance.

B. The Contractor shall schedule his operations to conform to the requirements specified herein and shall include in his construction schedule all events which will impact operation of the existing treatment facilities.

C. The Owner will continue to operate the treatment facilities during the construction period and will be responsible for maintaining effluent quality. The Contractor shall fully cooperate with the Owner, coordinate the construction schedule with the Owner and Engineer, and provide the necessary labor, equipment, and materials to prevent interruption to flow and treatment. The Owner and Engineer reserve the right to modify or expand the schedule during construction to meet prevailing conditions.

D. The Contractor shall not make any alterations to affect operation of the treatment facility without giving two weeks prior written notice to the Owner and Engineer requesting authorization to proceed. Except as noted herein, the Owner will perform all operation of existing valves or equipment.

E. Operation of valves or equipment by the Owner may be limited on specific occasions because of process limitations or unavailability of personnel. Delays caused by such limitations shall be expected and shall not be the basis for claim of extra costs by the Contractor.

F. The work specified in this Section shall be accomplished at such times that will be convenient to the Owner as specified in Section 01100, Summary of Work. Night work or overtime work by the Contractor to conform to these requirements shall be considered as normal procedure under this Contract, and the Contractor shall make no claim for extra compensation as a result of this night work or overtime work.

G. To maintain continuous treatment facilities operation during construction a phased removal and construction sequence shall be required. Specific constraints are outlined in this Section. The Contractor shall submit to the Engineer a detailed sequence of construction to complete the work while maintaining plant operation.

H. The Contractor shall furnish all temporary materials and equipment, such as flow diversion, bypass pumping, coffer dam, temporary power, etc., that may be required to complete the work of this Contract.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit a complete description of procedures to maintain plant operation to supplement the construction schedule developed. The description shall include step-by-step procedures, required duration, and specific procedures required to be performed by the Owner's personnel.

B. Submit complete plans of temporary systems required as part of this contract to maintain plant operations. The plans shall clearly delineate the intended location of these items and the Contractor's proposed method for phasing from existing to temporary to completed facilities.

1.03 MAINTAIN OPERATIONS

A. The existing treatment facilities shall be maintained in operation during construction of the proposed improvements. The degree of treatment during construction shall be equal to or exceed the degree of treatment required for effluent limits listed in the Florida Department of Environmental Protection (FDEP) Wastewater Facilities Construction Permit. Bypassing unit treatment operations or reduced levels of treatment shall not be permitted.

B. The Contractor shall be fully responsible for providing all temporary pumping, piping and yard piping, fuels, lubricants, chemicals, plumbing, power, heating, ventilating, air-conditioning, lighting, temporary structures, or whatever may be required to maintain wastewater treatment operations at no additional cost to the Owner. All details of temporary piping and temporary construction are not shown in the Drawings or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to maintain provisions for the Owner to provide wastewater treatment.

1.04 COORDINATION

A. The Contractor shall fully cooperate in coordinating their activities to provide the least interference with the Owner's operations and other contractors and utility companies working in the area and in the interfacing and connecting of the separate elements of the overall project work.

B. If any difficulty or dispute should arise in the coordination of activities, the Contractor shall immediately bring the problem to the Engineer's attention.

C. All contractors and subcontractors working on this site are subject to this requirement for cooperation, and all shall abide by the Engineer's decision in resolving project coordination problems without additional cost to the Owner.

D. FDEP and/or the Owner may require modifications or alterations to the Contractor's sequence of construction. The Contractor shall cooperate with the Owner and regulatory agencies to the maximum extent possible.

E. Certain parts of the construction work may need to be done outside normal working hours to avoid undesirable conditions. The Contractor shall provide notification to the Owner in advance in accordance with Section 01100, Summary of Work. The Contractor shall do this work at such times and at no additional cost to the Owner. Do not make connections between existing work and new work until necessary inspections, reviews, and tests, as required, have been completed on the new work and approved by the Engineer in accordance with the requirements of the Contract Documents.

F. Piping and equipment removals and modifications or electrical tie-ins requiring shutdown of flow to the plant, process bypass, or flow diversion shall be coordinated with and pre-approved by the Owner in writing at least 14 calendar days in advance.

G. All piping and conduit shown to cross existing roads in the same area shall be laid at one time so that disruption to plant access is minimized.

H. Interconnecting piping, utilities, and structures that are required to incorporate existing treatment systems, structures, or facilities with new treatment systems, structures, or facilities shall be performed at one time so that disruption to wastewater treatment operations is minimized.

1.05 CONSTRUCTION SEQUENCE OUTLINE

A. To meet the overall objectives of the project, certain elements of the work must be completed or substantially completed in certain sequences. The Contractor is

responsible and shall take any and all steps necessary to maintain continuous operation of the Owner's existing facilities. The Contractor shall develop and submit for approval by the Engineer and Owner a written construction sequence plan and schedule to minimize construction impacts on treatment plant operations and wastewater treatment efficiency. Certain stages shall be required to be completed before subsequent stages can be initiated.

B. To maintain wastewater treatment plant operation, the Contractor's construction sequence shall be subject to the constraints described in Article 1.06 of this Section.

1.06 CONSTRUCTION SEQUENCE OVERVIEW

A. The constraints described herein are to maintain the operation of the treatment facility and to minimize interruption. The existing facilities are to be modified, altered, or expanded and shall incorporate the proposed new facilities. Treatment shall be maintained, and effluent limitations and sampling requirements shall be complied with throughout the construction work. Refer to the Contract Drawings for existing and new facilities names, locations, acronyms, and abbreviations.

B. Various components may be completed concurrently to minimize downtime.

1.07 PROGRESS OF THE WORK

A. The work shall be started within the period stated in the Notice to Proceed, and the work shall be executed to prevent any delay to the general completion of the project.

B. The work shall be executed at such times and in or on such parts of the project and with such forces, materials, and equipment to ensure completion of the work in the time established by the Contract.

C. If the Contractor for their convenience and at their own expense desires to work outside the regular hours described in Section 01100, Summary of Work, the Contractor shall submit written notice to the Engineer and allow ample time for satisfactory arrangements to be made for the Owner and Engineer to observe the work in progress. The Contractor shall pay the expenses for extra work observation required of the Engineer for work outside regular work hours. The Contractor shall provide sufficient work lighting and any other necessary safety precautions for the different parts of the project as required to comply with all applicable federal and state regulations and with the approval of the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The following constraints shall be applied to all equipment, treatment units, and appurtenances and utility systems on the plant site.

1. Vehicular access for the Owner's personnel to the plant site and to all operating treatment units shall be maintained at all times.
2. Plant operating personnel shall have access to all areas that remain in operation.
3. Potable water supply to the plant shall remain operational at all times.
4. Sanitary facilities shall remain operational at all times.
5. Electric power and lighting service shall be uninterrupted.
6. If underground piping or utilities not shown on the Drawings are encountered, such piping or utilities shall not be disturbed without prior approval of the Engineer and Owner.
7. Before making a change in existing piping, electrical, or control systems, the Contractor shall inform the Owner and Engineer of such change and assist in instructing operations and maintenance personnel in any new operating procedures.
8. Portions of some pipelines must remain in service while alterations are being made on other portions. Piping systems that must remain in service shall be isolated by placing blind flanges, plugs, or caps on all open ends.
9. Flow to and through the treatment plant shall not be interrupted.
10. Before shutting down a piece of equipment to allow for rebuilding or re-piping, the Contractor shall have on hand all materials required to reconstruct the piping system in its new arrangement.
11. All temporary facilities provided by the Contractor must be demonstrated to be operational to the satisfaction of the Engineer before any existing systems can be removed from use. The temporary facilities are critical to the operation of the wastewater treatment facilities. Availability of these facilities must be maintained at all times. The Contractor must respond to requests from the Engineer and Owner for repair and maintenance immediately (7 days per week, 24 hours per day, including holidays). If the Contractor fails to immediately respond to requests for repair and maintenance, such repair and maintenance may be performed by the Owner. All costs associated with such repair and maintenance performed by the Owner shall be the responsibility of the Contractor.

3.02 SEQUENCE OF CONSTRUCTION

The following and as specified elsewhere are the minimum requirements and suggested sequence of construction for the Contractor's use in developing a sequence of construction and

maintenance of plant operation plan that shall be submitted to the Engineer and Owner for review:

A. The Contractor shall have an adequately sized and designed bypass pumping system in place and fully functional with demonstration to the Owner and Engineer before beginning work on the other items.

B. The Contractor may install a bypass system to fully bypass the existing screw pumps process to perform the work or implement a phased approach, if approved by the Owner under the Deductive Bid Alternate, with a smaller bypass pumping system installed and perform replacement, start-up, and testing and other related work, one screw pump at a time to maintain the required Class 1 Reliability.

C. If the Contractor chooses to replace one screw pump at a time with a bypass system meeting the reliability requirements, and if approved by the Owner under the Deductive Bid Alternate, the Contractor shall demolish the existing screw pumps and other items and install, test, and place into service new screw pumps and appurtenances in a sequence that is reviewed by the Engineer and Owner.

D. Bypass pump system shall remain in place during start-up and testing of the new screw pumps and until the new screw pumps operations are successfully demonstrated to the Engineer and Owner.

E. Bypass Pumping System (Refer to Drawing Sheet M4 for Additional Notes)

1. The Contractor shall be responsible for maintaining and operating all temporary systems during construction. The Contractor is responsible for any spills of screw pump contents. Spills of any nature caused by the Contractor shall be controlled and cleaned immediately. Any spills onsite must be recorded with volume and actions taken to clean area and reported to the Owner and Engineer, who shall coordinate with FDEP.

2. The Contractor shall verify the flow range with the Engineer and Owner before designing the bypass system. The work shall be completed to minimize bypass time. The Contractor shall submit a bypass plan to the Owner and Engineer for review and approval. The bypass system shall be capable of pumping the plant's current flows as follows:

    a. Minimum Day – 10.5 MGD.
    b. Average Day – 12.0 MGD.
    c. Peak Hour – 17.2 MGD.

3. The Contractor shall coordinate with the Engineer and Owner before taking any channels, pumps, gates, pipes, or other equipment out of service. All temporary systems shall be installed and operational, all flow diversion valves shall be checked and operable, and the flow channels shall be cleaned.

4. Installing cofferdams is expected to isolate the screw pump lift station to fully bypass the screw pumps. After the screw pumps have been isolated, the Contractor shall pump down and clean the isolated area. While the screw pumps are isolated for replacement, all work within each area shall be completed.

5. The Contractor shall refurbish the existing slide gates one at a time. After the area has been isolated, the Contractor shall pump down and clean the isolated area and then refurbish the slide gate.

6. The bypass pump system shall remain in place during start-up and testing of the new screw pumps and until the new screw pumps operation is successfully demonstrated to the Engineer and Owner.

END OF SECTION

SECTION 01820
TRAINING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

A. Instruct and train the Owner's personnel in the operation and maintenance of the equipment and systems supplied and/or installed under this Contract.

B. Incorporate operation and maintenance data and training services furnished by the suppliers into the training program such as shop drawings, equipment manuals, and start-up engineering and training assistance.

C. Ensure that system suppliers provide a qualified training instructor to help the Contractor train the Owner's employees in the proper operation and maintenance of all equipment and systems.

D. Prepare instructors and training materials required for complete factory, field, classroom, and hands-on training.

E. Furnish training videos and manuals during the training program.

F. Include in the total Contract Price the cost for training equipment; preparing training manuals; conducting classroom instructions; performing field, factory, and hands-on training; and coordinating and incorporating training service provided by suppliers and all other activities required to provide a comprehensive training program of sufficient length, as determined by the Owner.

1.02 WORK SEQUENCE

A. All factory training programs, if required, shall be completed before start-up of the Owner's system and shall use equipment similar to the Owner's equipment.

B. The field training programs shall be conducted in accordance with the approved schedule.

C. Individuals requiring training shall be trained in small groups during Mondays through Fridays. The Contractor will normally provide training during the 8-hour dayshift.

D. The hands-on training shall be conducted with a maximum of 10 students per instructor.

E. The Contractor shall coordinate and submit a training schedule to the Engineer 30 days before the first training event.

1.03 QUALITY ASSURANCE

A. Preparation of training materials and instructions to be provided shall be performed by personnel:

1. Trained and experienced in operation and maintenance of equipment and systems installed under this Contract.
2. Familiar with the training requirements of the Owner.

B. The Contractor shall furnish résumés, including three outside references, for each instructor to be used in the training program.

C. The Engineer and Owner may review the résumés. Based on the review of the résumés and contacts with references, the Engineer shall approve, request additional information, or reject proposed instructors for the training program. If a proposed instructor is rejected, the Contractor shall submit the résumé and references of another candidate within a reasonable time.

1.04 TRAINING PLAN

A. At the completion of the Work, the Contractor shall provide a competent and experienced person thoroughly familiar with the Work for not less than 3 days to instruct permanent operating personnel in the operation of equipment and control systems.

B. At least 30 days before training, the Contractor shall submit to the Engineer a detailed training plan including the following:

1. Title and objectives.
2. Training schedule.
3. Prerequisite training and experience of attendees.
4. Recommended types of attendees (e.g., managers, engineers, operators, maintenance staff).
5. Course description and outline of course content.
6. Duration.
7. Location (e.g., training center or site).
8. Format (e.g., lecture, self-study, demonstration, hands-on).
9. Instruction materials and equipment requirements.

1.05 FORM OF TRAINING MANUALS

A. The Contractor shall prepare training packages in the form of an instruction manual for use by the Owner's personnel. At least 30 days before the training, the Contractor shall submit the training packages to the Engineer for acceptance.

B. Format

1. Size: 8 1/2 x 11 inches (21.59 x 27.94 cm).

2. Paper: 20-pound (9.072 kg) minimum, white, for typed pages.

3. Text: Manufacturer's printed data or neatly word processed including the following:

   a. Table of contents.
   b. Pretest.
   c. Learning objectives.
   d. General operations, theory, and specific equipment information.

4. Drawings

   a. Provide reinforced punched binder tab, bind in with text.
   b. Reduce larger drawings and fold to size of text pages, not larger than 11 x 17 inch (27.94 x 43.18 cm).

5. Cover: Identify each volume with the following:

   a. Title of Project.
   b. Identity of separate structure or system as applicable.
   c. Identity of general subject matter covered in the manual.
   d. Locations.

C. Binders

1. Commercial quality three-post binders with durable and cleanable plastic covers.
2. Maximum post width shall be 3 inches (7.62 cm).
3. When multiple binders are used, correlate the information into related consistent groupings.

1.06 VIDEOTAPED TRAINING MATERIAL

The Contractor shall do the following:

A. Produce or provide video training material subject to approval of the Owner.

B. Furnish digital copies of each video recording. The Owner may request this in DVD format in a plastic case with title, the Owner's name, and time on a label in a clear plastic sleeve, at no additional cost.

C. Bear all costs associated with production and provision of the DVDs, if DVDs are requested by the Owner.

1.07 INSTRUCTIONS

A. At the completion of Work, the Contractor shall provide a competent and experienced person thoroughly familiar with the Work for a period of time as directed by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

B. The Contractor shall furnish four complete sets of operating instructions applying to each piece of equipment installed in conjunction with this Contract.

C. An "As-Installed" diagram of all control wiring and operating instructions shall be mounted in a watertight pocket on the inside door of the control panel of each unit.

D. Unless otherwise specified, the Contractor shall provide engraved metal, plastic tags, or instructions on any valve, switch, control, pipe or other piece of equipment which is not self-evident as to its function or mode of operation. This includes, but is not limited to, all exposed piping and all switches. This shall particularly apply to operations that must be manually sequenced.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01830
OPERATIONS AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

A. Compile product data and related information appropriate for the Owner's operation and maintenance of products furnished under the Contract.

1. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of the Specifications. The data presented in the O&M Manuals shall be specifically related to this Contract and application.
2. Incorporate operation and maintenance data furnished by the Owner, if any.

B. Furnish all labor, equipment, materials, and all other items to supply and deliver to the Owner two hardcopy and an electronic copy of O&M Manuals for the Work in accordance with the requirements of this Section.

C. Provide two hardcopy and an electronic copy of O&M Manuals for all equipment, including instrumentation, electrical, and process control system equipment and software for the entire Facility.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Manuals which, in general, shall have two levels: a facilities-wide systems level and an individual-component level.

1. The facilities-wide systems level shall do the following:

a. Describe the facilities-wide systems, including diagrams.
b. Explain start-up, shutdown, normal operations, and malfunctions of the facilities-wide systems.
c. Tabulate a lubrication schedule for the facilities-wide systems.

d. Describe preventive maintenance checking procedures for the facilities-wide systems.
e. Include a cross-reference to all individual component manuals.

2. The individual-component level shall contain the following:

a. Storage requirements.
b. Installation instructions.
c. Alignment instructions and tolerances.
d. Operating instructions.
e. Troubleshooting instructions.
f. Lubrication requirements.
g. Maintenance instructions.
h. Parts list.
i. Recommended spare parts list and how to obtain same.

B. Format

1. Size: 8 1/2-x-11-inch format for narrative and figures. Larger standard sizes are acceptable for drawings.

2. Text: Manufacturer's printed data or neatly word-processed.

3. Provide a new page for each separate product or each piece of operation equipment.

a. Provide a word-processed description of the product and major component parts of equipment.
b. Provide indexed tabs.

4. Cover: Identify each volume with the typed title, "OPERATION AND MAINTENANCE INSTRUCTIONS," listing the following:

a. Title of Project.
b. Identity of separate structure as applicable.
c. Identity of general subject matter covered in the manual.

5. All word processing must be done using the latest version of Microsoft Word or a version specified by the Owner.

6. Arrange the data into related consistent groupings and cover all with a table of contents and index with page numbering of all sheets.

C. The Contractor shall submit the following:

1. Equipment Manuals—O&M Instruction Manual for each piece of equipment shall be submitted to the Owner with delivery of the equipment.
2. Systems O&M Manuals—Systems O&M Manuals, indexed and submitted to the Owner no later than 14 days before the Facility's start-up. Systems O&M Manuals will be complete except for field results and refinements added as result of demonstrations.
3. Final O&M Manuals—Final Equipment and Systems O&M Manuals, indexed and submitted to the Owner before the Substantial Completion under this Contract.
4. The cost of these Manuals shall be included in the total Contract Price.

D. Any modifications required after final O&M submission shall be made to the manuals by issuance of complete replacement O&M manuals. Addenda with pages for insertion into manuals previously provided are not allowed. The updated manuals shall be accompanied by a written description of the changes made to the manual.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Florida Administrative Code (FAC)

1. Rule 62-600.410 FAC—Operation and Maintenance Requirements – Domestic Wastewater Facilities.

1.04 QUALITY ASSURANCE

A. Data shall be prepared by personnel:

1. Trained and experienced in maintaining and operating the described products.
2. Familiar with requirements of this Section.
3. Skilled as a technical writer to the extent required to communicate essential data.
4. Skilled as a person competent to prepare required drawings.

1.05 CONTENTS, EACH VOLUME

A. Neatly word-processed table of contents for each volume, arranged in systematic order, to include the following:

1. Contractor, name of responsible principal, address, fax number, and telephone number.

2. A list of each product required to be included, indexed to content of the volume.

3. A list with each product, name, address, fax number, and telephone number of the following:

   a. Subcontractor or installer.
   b. A list of each product to be included, indexed to content of the volume.
   c. Identify area of responsibility of each subcontractor or installer, if more than one.
   d. Local source of supply for parts and replacement.
   e. Manufacturer.

4. Identify each product by product name and other identifying symbols as set forth in the Contract Documents.

B. Product Data

1. Include only those sheets that are pertinent to the specific product.

2. Annotate each sheet to achieve the following:

   a. Clearly identify the specific product or part installed.
   b. Clearly identify data applicable information.
   c. Delete references to inapplicable information.

C. Drawings

1. Supplement product data with drawings as necessary to illustrate the following clearly:

   a. Relations of component parts of equipment and systems.
   b. Control and flow diagrams.
   c. Owner Tag Numbers.

2. Coordinate drawings with information in Record Documents to ensure correct illustration of completed installation.

3. Do not use Record Documents as maintenance drawings.

D. Written text as required to supplement product data for the particular installation:

1. Organize in consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.
3. Describe how the complete system is to operate.

E. Copy of pertinent information related to warranty, bond, and service Contract issued.

1. Provide information sheet for Owner's personnel with the following information:

a. Proper procedures in event of failure.
b. Instances that might affect the validity of warranties or bonds.

F. Training manuals used in training courses will become part of this Manual.

1.06 MANUAL FOR MATERIALS AND FINISHES

A. Content, for architectural products, applied materials, and finishes:

1. Manufacturer’s data, giving full information on products:

a. Catalog number, size, composition.
b. Color and texture designations.
c. Information required for re-ordering special-manufactured products.

2. Instructions for care and maintenance:

a. Manufacturer’s recommendation for types of cleaning agents and methods.
b. Cautions against cleaning agents and methods that are detrimental to product.
c. Recommended schedule for cleaning and maintenance.

B. Content, for moisture-protected and weather-exposed products:

1. Manufacturer’s data, giving full information on products:

a. Applicable standards.
b. Chemical composition.
c. Details of installation.

2. Instructions for inspection, maintenance, and repair.

C. Additional requirements for maintenance data as required by other sections of the Specifications.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Content, for each electrical, mechanical, instrumentation, and communication system, as appropriate:

1. A table identifying each piece of equipment, each associated control or instrument, the location of the control or instrument, and the function of the control or instrument.

2. A description of the system and its component parts:

a. Function, normal operating characteristics, and limiting conditions for the system, the sub-system, and the component parts.
b. Performance curves, engineering data, and tests.
c. Complete nomenclature and commercial numbers of replaceable parts.

3. Circuit directories of panel board:

a. Electrical service.
b. Controls.
c. Communications.

4. As-installed color-coded wiring diagrams.

5. Instrument loop diagrams showing the path that a control or instrumentation signal takes from its origin to the action it takes.

a. An electrical schematic for each item.
b. A chart listing the controls/instruments in a loop identifying the equipment's abbreviated symbol, a description of the symbol,

design criteria, process flow, quantity supplied, and manufacturer's model and serial number.

6. Operating procedures:

    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Special operating instructions.

7. Maintenance procedures:

    a. Routine operations.
    b. Guide to "troubleshooting."
    c. Disassembly, repair, and re-assembly.
    d. Alignment, adjustment, and checking.

8. The manufacturer's operating and maintenance instructions.

9. A list of the original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

10. Other data as required under other sections of the Specifications.

11. Abnormal and emergency operations:

    a. Potential overloads.
    b. Procedures for equipment breakdown.
    c. Action to be taken in a power outage.
    d. Identity of alarms by equipment location and action to correct.
    e. Equipment safety features, requirements, and potential hazards.

12. Programming manuals for programmable devices including list of standard programming.

B. Content, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts:

    a. Function, normal operating characteristics, and limiting conditions.
    b. Performance curves, engineering data, and tests.
    c. Complete nomenclature and commercial number of replaceable parts.
    d. Model number and name plate data for each piece of equipment.

e. Assembly drawings.
f. List of all special tools required to service equipment and/or systems including where the tools are stored.

2. Operating procedures:

a. Start-up, break-in, routine, and normal operating instructions.
b. Regulation, control, stopping, shut-down, and emergency instructions.
c. Summer and winter operating instructions.
d. Special operating instructions.
e. Control settings and ranges.

3. Maintenance procedures:

a. Type and frequency of preventive maintenance activities required for each piece of equipment.
b. Guide to "troubleshooting."
c. Disassembly, repair, and re-assembly.
d. Alignment, adjusting, and checking.

4. Servicing and lubrication schedule:

a. List of lubricants required.

5. Period between lubrications.

6. Manufacturer's printed operating and maintenance instructions. (This is not to be a generalized catalog of the entire product line.)

7. Description of sequence of operation.

8. The original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance:

a. Predicted life of parts subject to wear.
b. Items recommended to be stocked as spare parts.

9. As-installed control diagrams.

10. Each Contractor's coordination drawings.

11. List of the original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of the Specifications.

13. Charts of equipment, instrument, and valve tag numbers with location and function:

    a. Reference drawing which shows equipment, instrument, or valve location.
    b. Manufacturer's model and serial number.
    c. Valve actuator type (manual, hydraulic, electric, or pneumatic).

14. Local services (process water and air, drains, HVAC, natural gas and steam).

C. The Contractor shall prepare and include additional data when the need for such data becomes apparent during instruction of the Owner's personnel.

D. Additional requirements for O&M data required by other sections of the Specifications.

PART 2 PRODUCTS

2.01 O&M MANUALS

A. Printed in Binders: The manuals shall be printed and supplied in binders that are as follows:

1. Three ring binders with hard covers.
2. Filled to not more than 75% capacity.
3. When multiple binders are used, arrange the data into volumes containing related equipment, products and systems.
4. Label each binder volume with a volume number, total number of volumes (e.g., 1 of 3), and descriptive volume title.
5. Confirm binder arrangement and layout with Owner if clarification or guidance is needed.

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIVISION 2

SITE CONSTRUCTION

SECTION 02220
DEMOLITION AND MODIFICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and demolish, modify, remove, and dispose of work shown on the Drawings and as specified in this Section.

B. The work includes but is not limited to demolishing, modifying, and removing existing materials, equipment, or work necessary to install the new work as shown on the Drawings and as specified in this Section and to connect with existing work in an approved manner.

C. Demolition, modifications, and removals which may be specified under other sections shall conform to requirements of this Section.

D. Demolition and modifications include:

1. Removal and disposal of existing screw pumps and motors, electrical equipment, and miscellaneous items as shown on the Drawings.
2. Off-site disposal of excess and unacceptable materials.

E. Blasting and the use of explosives will not be permitted for any demolition work.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit to the Engineer six copies of proposed methods and operations of demolition of the structures and modifications before beginning work. Include in the schedule the coordination of shutoff, capping, and continuation of utility service as required.

B. Furnish a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's operations. The sequence shall be compatible with sequence of construction and shutdown coordination requirements.

C. Before beginning demolition work, the Contractor shall complete all modifications necessary to bypass the affected structure. Actual work shall not begin until the Engineer has observed and approved the modifications and authorized beginning the demolition work in writing.

1.03 QUALITY ASSURANCE

A. The Contractor shall engage the service of a professional engineer registered in the State of Florida for the design of the temporary shoring/bracing of the existing structure and hung utilities during the demolition, repair, and replacement of the Screw Pumps, etc.

1.04 JOB CONDITIONS

A. Protection

1. The Contractor shall conduct the demolition and removal work to prevent damage or injury to structures, equipment, piping, instrumentation, conduit, light fixtures, etc., and occupants of the structures and to adjacent features that might result from falling debris or other causes, and not interfere with the use and free and safe passage to and from adjacent structures.

B. Scheduling

1. The Contractor shall carry out operations to avoid interference with operations and work in the existing facilities.

C. Notification

1. At least 48 hours before beginning demolition or removal, the Contractor shall notify the Engineer in writing of the proposed schedule of the demolition or removal. The Owner shall inspect the existing equipment and identify and mark those items that are to remain on the property of the Owner. No removals shall be started without the permission of the Engineer.

D. Conditions of Structures

1. The Owner and the Engineer assume no responsibility for the actual condition of the structures to be demolished or modified.
2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within a structure may occur before the start of demolition work.

E. Repairs to Damage

1. The Contractor shall promptly repair damage caused to adjacent facilities by demolition operation when directed by the Engineer and at no cost to the Owner. Repairs shall be made to a condition at least equal to that which existed before construction.

F. Traffic Access

1. The Contractor shall conduct demolition and modification operations and remove equipment and debris to ensure minimum interference with roads onsite and to ensure minimum interference with occupied or used facilities.
2. Special attention is directed towards maintaining safe and convenient access to the existing facilities by plant personnel and plant associated vehicles.

1.05 RULES AND REGULATIONS

A. The Florida Building Code or the City shall control the demolition, modification or alteration of the existing buildings or structures.

B. No building or structure or any part thereof shall be demolished until an application has been filed with the Building Inspector and a permit issued. The fee for this permit shall be the Contractor's responsibility.

1.06 DISPOSAL OF MATERIAL

A. Salvageable material and equipment shall become the property of the Owner. The Contractor shall dismantle all such items to a size that can be readily handled and deliver them to a designated storage area.

B. All other material and items of equipment shall become the Contractor's property and must be removed from the site.

C. Storing or selling removed items on the site will not be allowed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. All materials and equipment removed from existing work shall become the property of the Contractor, except for those which the Owner has identified and marked for his/her use. All materials and equipment marked by the Owner to remain shall be carefully removed so as not to be damaged and shall be cleaned and stored on or adjacent to the site in a protected place specified by the Engineer or loaded onto trucks provided by the Owner.

B. The Contractor shall dispose of all demolition materials, equipment, debris, and all other items—except those marked by the Owner to remain—off the site and in conformance with all existing applicable laws and regulations.

C. Pollution Controls

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

    a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
    b. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing before starting the work.

3.02 STRUCTURAL REMOVALS

A. The Contractor shall remove structures to the lines and grades shown unless otherwise directed by the Engineer.

B. All demolition debris shall be removed and taken from the site, unless otherwise approved by the Engineer.

C. After parts or all of slabs and like work which tie into new work or existing work are removed, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.

3.03 DEMOLITION, REPLACEMENT, AND REPAIR

A. Structural elements shall not be overstressed. The Contractor shall be responsible for shoring and/or bracing as required and indicated on the Drawings for adequate structural support as a result of work performed.

3.04 CLEAN-UP

A. The Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, the Contractor shall remove all materials, equipment, waste, and debris of every sort and shall leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 02370
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, bays, storm systems, or other water impoundments, ground surfaces, or other property as required by federal, state, and local regulations.

B. The Contractor shall provide protective covering for disturbed areas upon suspension or completion of land-disturbing activities. Permanent vegetation shall be established at the earliest practicable time. Temporary and permanent erosion-control measures shall be coordinated to ensure economical, effective, and continuous erosion and siltation control throughout the construction and post-construction period.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Florida Department of Transportation (FDOT)

1. FDOT Section 103—Temporary Work Structures.
2. FDOT Section 104—Prevention, Control, and Abatement of Erosion and Water Pollution.
3. FDOT Section 530—Revetment Systems.
4. FDOT Section 982—Fertilizer.
5. FDOT Section 985—Geosynthetic Materials.

B. City of Clearwater Technical Specifications

1. Section IV, Article 207—Erosion and Sedimentation Control.

1.04 REGULATORY REQUIREMENTS

A. The Contractor shall prevent damage to properties outside the construction limits from siltation due to construction of the project and assume all responsibilities to the affected property owners for correction of damages which may occur. Erosion-control measures shall be performed conforming to the requirements of and in accordance with plans approved by applicable state and local agencies and as specified by the erosion-control portion shown on the Drawings and as required by these Specifications. The Contractor shall not allow mud and debris to accumulate in the streets or enter drainage ditches, canals, or waterways. Should the Contractor pump water from excavations during construction, appropriate siltation preventative measures shall be taken before the pumped water is discharged into any drainage ditch, canal, or waterway.

1.05 PRACTICES

The Contractor shall adhere to the following:

A. Avoid dumping soil or sediment into any stream bed, pond, ditch, or watercourse.

B. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.

C. Avoid equipment crossings of streams, creeks, and ditches where practicable.

1.06 EROSION AND SEDIMENT-CONTROL DEVICES AND FEATURES

A. The Contractor shall construct all devices (silt fences, retention areas, etc.) for sediment control at the locations required to protect federal, state, and local water bodies and water courses and drainage systems before beginning to excavate the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.

B. The Contractor shall use mulch to temporarily stabilize areas subject to excessive erosion and to protect seed beds after planting where required.

C. Filter fabric, hay bales, or other approved methods shall be placed and secured over the grates of each existing inlet, grating, or storm pipe opening near the area of excavation to prevent silt and debris from entering the storm systems.

D. The Contractor shall use silt fences, hay bales, and floating turbidity barriers as shown on the plans or as directed by the Owner or Engineer to restrict movement of sediment from the site.

E. The Contractor shall establish vegetative cover on all unpaved areas disturbed by the work.

PART 2 PRODUCTS

2.01 GENERAL

A. Open-mesh biodegradable mulching cloth.

B. Fertilizer shall be 10-10-10 grade or equivalent.

C. Lime shall be Dolomitic Agricultural Ground limestone, in accordance with FDOT Section 982.

D. Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.), in accordance with FDOT Section 985, wired to galvanized wire mesh fencing and supported by wood or metal posts.

E. Floating or staked turbidity barriers as specified in FDOT Section 985 and FDOT Section 104.

F. Erosion Stone: FDOT Section 530.

1. Sand-Cement Riprap.
2. Concrete Block.
3. Rubble 20 to 300 pounds each.

G. Filter Fabric for placing under Riprap shall meet the requirements of FDOT Section 985.

H. Baled hay or straw in accordance with FDOT Section 104.

PART 3 EXECUTION

3.01 CLEARING

A. The Contractor shall schedule and perform clearing and grubbing so that subsequent grading operation and erosion-control practices can follow immediately after. Excavation, borrow, and embankment operations will be conducted as a continuous operation. All construction areas not otherwise protected shall be planted with permanent vegetative cover within 30 working days after completing active construction.

3.02 STABILIZING

A. The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. All disturbed areas outside of embankment left exposed will, within 30 working days of completion of any phase of grading, be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

3.03 REGULATORY REQUIREMENTS

A. Whenever land-disturbing activity is undertaken on a tract, a ground cover sufficient to restrain erosion must be planted or otherwise provided within 30 working days on that portion of the tract upon which further active construction is to be undertaken.

B. If any earthwork is to be suspended for any reason for longer than 30 calendar days, the areas involved shall be seeded with vegetative cover or otherwise protected against excessive erosion during the suspension period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility to control erosion in that area.

3.04 VEGETATIVE COVER

A. Preparation of Seedbed. Areas to be seeded shall be scarified a depth of 4 inches until a firm, well-pulverized, uniform seedbed is prepared. Fertilizer shall be applied during the scarification process in accordance with the following rates:

1. Fertilizer—10 to 15 pounds per 1,000 square feet.

B. The Contractor shall mulch all areas immediately after seeding. Mulch shall be applied and anchored as specified previously in this Section.

3.05 MAINTENANCE

A. The Contractor shall maintain all temporary and permanent erosion-control measures in functioning order. Temporary structures shall be maintained until such time as vegetation is firmly established and grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired. No additional payment will be made to the Contractor for re-establishing erosion-control devices, which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the project.

B. The Contractor shall remove all silt, sediment, and debris buildup regularly to maintain functioning storm systems and erosion-control devices.

3.06 REMOVAL OF SEDIMENT CONTROL DEVICES

A. Near completion of the project, when directed by the Engineer, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion-control devices in seeded areas shall be left in place until the grass is established. The Contractor shall seed areas around devices and mulch after removing or filling temporary control devices.

B. The Contractor shall clean up all areas at the completion of the project.

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03600
GROUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install grout complete as shown on the Drawings and as specified in this Section.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

1. Commercially manufactured nonshrink cementitious grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures, and the proposed mix of the grout.
4. Concrete grout. The submittal shall include the mix design, constituent quantities per cubic yard, all pozzalan materials proposed with their chemical analysis, admixtures, coarse and fine aggregate analysis, cement chemical and physical analysis and the water/cement ratio.

B. Certifications: Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.

C. Qualifications: Grout manufacturers shall submit documentation that they have at least 10 years experience in the production and use of the proposed grouts which they will supply.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C33/C33M—Standard Specification for Concrete Aggregates.
2. ASTM C150/C150M—Standard Specification for Portland Cement.
3. ASTM C531—Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
4. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
5. ASTM C827/C827M—Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
6. ASTM C1107/C1107M—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
7. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.

B. US Army Corps of Engineers Standard (CRD)

1. CRD C-621—Corps of Engineers Specification for Non-Shrink Grout.

1.04 QUALITY ASSURANCE

A. Pre-installation Conference

1. Well in advance of grouting, the Contractor shall hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing, and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days before its scheduled date.

B. Services of Manufacturer's Representative

1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in installing the products, shall attend the pre-

installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided as required to correct installation problems.

C. Field Testing

1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc., for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
2. The field testing of concrete grout shall be performed on the following items and shall be tested by the Owner to verify conformity with this Section:

a. Concrete placements—compressive strength (cylinders), compressive strength (cores), slump, and air content.

(1) Compressive strength testing cylinders shall be taken at the site and a minimum of four shall be prepared. Two shall be tested at 7 days and one tested at 28 days. One shall be kept as a spare to be tested at a future date chosen by the EOR or Owner.

1.05 WARRANTIES

A. Warranties shall be in accordance with the Supplementary Conditions of the Construction Contract, Section 01000, Project Requirements, and Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers, and printed instructions.

C. Store materials in full compliance with the manufacturer's recommendations. Total storage time from the date of manufacture to the date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.

D. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.

E. Nonshrink-cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.

F. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three-component systems requiring only blending as directed by the manufacturer.

1.07 QUALIFICATIONS

A. The grout manufacturer shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.

1.08 DEFINITIONS

A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state, and bonds to a clean base plate.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and product or catalog number is to establish the standard of quality desired.

B. To standardize appearance, like materials shall be the products of one manufacturer or supplier.

2.02 MATERIALS

A. Nonshrink Cementitious Grout

1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107/C1107M, Grades B or C and CRD C-621. Grouts shall be Portland-cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents, and shall require only the addition of water. Nonshrink cementitious grouts shall not contain

expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827/C827M.

a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U.S. Grout Corp.; or equal.

b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp.; or equal.

B. Nonshrink Epoxy Grout

1. Nonshrink epoxy based grout shall be a pre-proportioned, three-component, 100% solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30x10-6 when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Inc.; Five Star Epoxy Grout by US Grout Corp.; Sikadur 42 Grout Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co.; or equal.

C. Cement Grout

1. Cement grouts shall be a mixture of one part Portland cement conforming to ASTM C150/C150M, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33/C33M with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall be proportioned with cement, coarse and fine aggregates, water, water reducer, and an air-entraining agent to produce a mix having an average strength of 4,000 psi at 28 days. Coarse aggregate size shall be 3/8 inch maximum. Slump should not exceed 5 inches and should be as low as practical yet still retain sufficient workability. The w/c ratio shall be a maximum of 0.44.

E. Water

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 EXECUTION

3.01 PREPARATION

A. Grout shall be placed over cured concrete that has attained its full design strength unless otherwise approved by the Engineer.

B. Concrete surfaces to receive grout shall be clean and sound, free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints, and free of all loose material or foreign matter which may affect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance, and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil, or other deleterious substances from metal embedments or bottom of baseplates before installing the grout.

E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours before the placing of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, using a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24-hour period, visible water shall be removed from the surface before grouting. An adhesive bonding agent should only be used in lieu of surface saturation when approved by the Engineer for each specific location of grout installation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

G. Construct grout forms or other leak-proof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer.

Forms shall be of adequate strength, securely anchored in place, and shored to resist the forces imposed by the grout and its placement.

1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.

H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks, or other approved means. The shims, wedges, and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

3.02 INSTALLATION—GENERAL

A. The Contractor shall mix, apply, and cure products in strict compliance with the manufacturer's recommendations and this Section.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90ºF during grouting and for at least 24 hours after or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90ºF range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or contraction joint.

F. Reflect all existing underlying expansion, contraction, and construction joints through the grout.

3.03 INSTALLATION—CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with the manufacturer's recommendations. Do not add cement, sand, pea gravel, or admixtures without prior approval by the Engineer.

B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3 inches deep shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45º angle from the lower edge of the bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding, or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION—NONSHRINK EPOXY GROUTS

A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the

grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener, and aggregate.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90ºF.

C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.05 INSTALLATION—CONCRETE GROUT

A. Screed underlying concrete to the grade shown on the Drawings. Provide the surface with a broomed finish, aligned to drain. Protect and keep the surface clean until placement of concrete grout.

B. Remove the debris and clean the surface by sweeping and vacuuming all dirt and other foreign materials. Wash the tank slab using a strong jet of water. Flushing debris into tank drain lines will not be permitted.

C. Saturate the concrete surface for at least 24 hours before placing the concrete grout. Saturation may be maintained by ponding, by the use or soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just before placing the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16- to 1/8-inch-thick cement paste.

D. Provide grout contraction joints as indicated on the Drawings.

E. Finish and cure the concrete grout as specified by the given equipment manufacturer. The grout shall be wet cured at a minimum for 7 days.

3.06 SCHEDULE

A. The following list indicates where the particular types of grout are to be used:

1. General purpose nonshrink cementitious grout: Use at all locations where nonshrink grout is called for on the plans except for base plates greater than 3 feet wide by 3 feet long and, except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.
2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3 feet by 3 feet. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.
3. Nonshrink epoxy grout: Use for setting anchor rods, anchor bolts, and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
4. Cement grout: Cement grout may be used for grouting incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting primary structural steel members such as columns and girders.
5. Concrete grout: Where indicated on the Drawings.

END OF SECTION

DIVISION 9

FINISHES

SECTION 09900
PAINTING AND COATING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes materials for and application of painting and coating systems for the following surfaces:

1. Submerged metal.
2. Buried and aboveground metal.
3. Submerged concrete and masonry.
4. Exposed concrete and masonry.
5. Nonferrous, galvanized, and other miscellaneous metals.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Submit manufacturer’s data sheets showing the following information:

1. Percent solids by volume (sbv).
2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
3. Recommended surface preparation.
4. Recommended thinners.
5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
6. Application instructions including recommended equipment and temperature limitations.
7. Curing requirements and instructions.

C. Submit color swatches.

D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.

E. Submit material safety data sheets for each coating.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Architectural Manufacturers Association (AAMA)

1. AAMA 2604—Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO T-259—Standard Method of Test for Resistance of Concrete to Chloride Ion Penetration.

C. American Society for Testing and Materials (ASTM)

1. ASTM A780/A780M—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
2. ASTM B117—Standard Practice for Operating Salt Spray (Fog) Apparatus.
3. ASTM C67/C67M—Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
4. ASTM C97/C97M—Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
5. ASTM C140/C140M—Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
6. ASTM C307—Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
7. ASTM C501—Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
8. ASTM C518—Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Apparatus.
9. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
10. ASTM C580—Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concrete.
11. ASTM C793—Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants.

12. ASTM D520—Standard Specification for Zinc Dust Pigment.
13. ASTM D522/D522M—Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
14. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
15. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
16. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
17. ASTM D870—Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.
18. ASTM D1002—Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal).
19. ASTM D1014—Standard Practice for Conducting Exterior Exposure Tests of Paints and Coatings on Metal Substrates.
20. ASTM D1308—Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems.
21. ASTM D2240—Standard Test Method for Rubber Property—Durometer Hardness.
22. ASTM D2370—Standard Test Method for Tensile Properties of Organic Coatings.
23. ASTM D2697—Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.
24. ASTM D2794—Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
25. ASTM D3273—Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
26. ASTM D3734—Standard Specification for High-Flash Aromatic Naphthas.
27. ASTM D4060—Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
28. ASTM D4138—Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.
29. ASTM D4141/D4141M—Standard Practice for Conducting Black Box and Solar Concentrating Exposures of Coatings.
30. ASTM D4258—Standard Practice for Surface Cleaning Concrete for Coating.
31. ASTM D4260—Standard Practice for Liquid and Gelled Acid Etching of Concrete.
32. ASTM D4261—Standard Practice for Surface Cleaning Concrete Masonry Units for Coating.
33. ASTM D4263—Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

34. ASTM D4541—Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
35. ASTM D4585/D4585M—Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation.
36. ASTM D4587—Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
37. ASTM D4787—Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
38. ASTM D5590—Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay.
39. ASTM D5894—Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog-Dry Cabinet and a UV/Condensation Cabinet).
40. ASTM D6386—Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
41. ASTM D6695—Standard Practice for Xenon-Arc Exposures of Paint and Related Coatings.
42. ASTM D6904—Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry.
43. ASTM D7091—Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
44. ASTM D7234—Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
45. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
46. ASTM F1869—Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
47. ASTM G210—Standard Practice for Operating the Severe Wastewater Analysis Testing Apparatus.

D. American Water Works Association (AWWA)

1. AWWA C203—Coal-Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied.
2. AWWA C209—Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings.

E. British Standards Institution (BSI)

1. BS EN 598—Ductile Iron Pipes, Fittings, Accessories, and their Joints for Sewerage Applications – Requirements and Test Methods.

F. National Association of Corrosion Engineers International (NACE)

1. NACE SP0188—Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
2. NACE TM0174—Laboratory Methods for the Evaluation of Protective Coatings and Lining Materials on Metallic Substrates in Immersion Service.

G. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

H. Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE)

1. SSPC PA-1—Shop, Field, and Maintenance Painting of Steel.
2. SSPC PA-2—Procedure for Determining Conformance to Dry Coating Thickness Requirements.
3. SSPC SP-1—Solvent Cleaning.
4. SSPC SP-2—Hand Tool Cleaning.
5. SSPC SP-3—Power Tool Cleaning.
6. SSPC SP-5/NACE No. 1—White Metal Blast Cleaning.
7. SSPC SP-6/NACE No. 3—Commercial Blast Cleaning.
8. SSPC SP-7/NACE No. 4—Brush-Off Blast Cleaning.
9. SSPC SP-8—Pickling.
10. SSPC SP-10/NACE No. 2—Near-White Blast Cleaning.
11. SSPC SP-11—Power Tool Cleaning to Bare Metal.
12. SSPC SP-12/NACE No. 5—High- and Ultra-High-Pressure Water Jetting.
13. SSPC SP-13/NACE No. 6—Surface Preparation of Concrete.
    a. ICRI CSP1-6—Concrete Surface Profile 1 – 6.
14. SSPC SP-14/NACE No. 8—Industrial Blast Cleaning.
15. SSPC SP WJ-1—Waterjet Cleaning of Metals – Clean to Bare Substrate.
16. SSPC SP WJ-2—Waterjet Cleaning of Metals – Very Thorough Cleaning.
17. SSPC SP WJ-3—Waterjet Cleaning of Metals – Thorough Cleaning.
18. SSPC SP WJ-4—Waterjet Cleaning of Metals – Light Cleaning.

I. US Department of Defense (MIL)

1. MIL-C-5541—Chemical Conversion Coatings on Aluminum and Aluminum Alloys.
2. MIL-C-18480B—Coating Compound, Bituminous, Solvent, Coal-Tar Base.
3. MIL-D-3134—Deck Covering Materials.
4. MIL-DTL-24441—General Specification for Paint, Epoxy-Polyamide.
5. MIL-P-21035—Paint High Zinc Dust Content, Galvanizing Repair.

PART 2 MATERIALS

2.01 PAINTING AND COATING SYSTEMS

The following index lists the various painting and coating systems by service and generic type:

PAINT COATINGS SYSTEM INDEX		
No.	Title	Generic Coating
Submerged Metal Coating Systems		
2.	Submerged Metal, Mild to Moderate Wastewater, Raw Water (Nonpotable) or Raw Sewage in Aerobic Environments	Zinc+MIO blend urethane/Cycloaliphatic amine epoxy
5.	Submerged Metal Requiring Extremely High Abrasion Resistance, Raw Sewage or Grit Slurries	Epoxy-ceramic
Metal Coating Systems		
21.	Metal, Standard Pipe Coating System (Suitable for Buried and Aboveground)	Epoxy/epoxy/epoxy
Submerged Concrete and Masonry Coating Systems		
32.	Exposed Concrete and Masonry, Mild to Moderate Corrosive Environment	Modified polyamine epoxy
Exterior/UV-Exposed Concrete and Masonry Coating Systems		
42.	Existing or Coating Concrete and Masonry, Atmospheric Weathering Environment	Acrylic emulsion/acrylic emulsion
Nonferrous, Galvanized, and Other Miscellaneous Metals Coating Systems		
62.	Galvanized Steel, Stainless Steel, Aluminum, or Copper	Low-Stress Epoxy/ Aliphatic Polyurethane/ Aliphatic Polyurethane

A. These systems are specified in detail in the following paragraphs. For each system, the required surface preparation, coating materials, and thickness are described. If the specified surface preparation, coating materials, or thickness differs from the coating manufacturer's written instructions at the time of application, the manufacturer's instructions shall govern.

B. Only products of one manufacturer may be used throughout any particular coating system.

C. The following products are listed as a reference standard for this Section. All high-performance coatings shall be a product of Tnemec International or Induron. No other manufacturers will be permitted with prior approval of the Engineer.

D. To be considered for approval, potential alternate products must:

1. Be submitted by the manufacturer a minimum of 10 days before the project bid date to allow time for review.
2. Be the same generic type and have the same solids by volume (sbv).
3. Maintain the specified total dry film thickness.
4. Meet or exceed the performance criteria of the originally specified coatings in Article 2.02 of this Section.
5. Include a side-by-side comparison of equality including generic coating description, volume solids, ASTM performance test results, etc.
6. Be endorsed by the manufacturer for their intended use on the project.

E. All dry film thicknesses in the coating systems below are listed in mils.

F. Submerged Metal Coating Systems

1. System No. 2—Submerged Metal, Mild to Moderate Wastewater, Raw Water (Nonpotable) or Raw Sewage in Aerobic Environments:

a. Type: Tnemec Series 104 Cycloaliphatic Amine Epoxy (82% sbv) with a Series 1 Omnithane Zinc/Micaceous Iron Oxide Blend Modified Aromatic Polyurethane Primer (61% sbv) at a total film thickness of 14.5 to 19.5 mils.
b. Service Conditions: For use with metal pipes or structures (such as scum troughs, sluice gates, clarifier mechanisms, or piping) continuously submerged in mild to moderate (aerobic) wastewater conditions, such as clarifiers, chlorine contact basins, aeration basins, settling basins, and other open-top structures.
c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface; abrasive blast in accordance with SSPC SP-10/NACE No. 2.
d. Prime Coat: Tnemec Series 1 Omnithane at 2.5 to 3.5 mils.
e. Stripe Coat (Weld Seams and Edges): Tnemec Series 104 Hi-Build Epoxoline at 4.0 to 6.0 mils.
f. Intermediate Coat: Tnemec Series 104 Hi-Build Epoxoline at 6.0 to 8.0 mils.

g. Finish Coat: Tnemec Series 104 Hi-Build Epoxoline at 6.0 to 8.0 mils.

2. System No. 5—Submerged Metal Requiring Extremely High Abrasion Resistance, Raw Sewage or Grit Slurries:

a. Type: Two-component epoxy resin/ceramic having 100% volume solids and having the following characteristics:

Tensile shear adhesion (ASTM D1002):	2,500 psi (min)
Shore D hardness (minimum):	85
Abrasion resistance (ASTM D4060):	0.8 mg (max) loss per 1,000 cycles

b. Service Conditions: For use as a lining for pump volutes, pump impellers, piping, valves, and heat exchanger tubes subject to severe abrasion service.

c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface. Abrasive blast in accordance with SSPC SP-10/NACE No. 2.

d. Coating System: Apply two coats (each a different color) to a minimum thickness of 10 mils per coat. Minimum total coating thickness shall be 20 mils. Product: THORTEX Cerami-Tech C.R. as applied by Western Industrial Technology, Inc., Fullerton, California, or Paragon Industries, Horsham, Pennsylvania; Belzona 1341; or equal.

G. Buried Metal Coating Systems

1. System No. 21—Buried Metal:

a. Type: Polyamidoamine Epoxy (67% sbv) primer, intermediate and finish coat with a UV-stable Finish Coat option for exposed non-immersion areas. Total film thickness is 11.0 to 24.0 mils.

b. Service Conditions: Metal, such as pipe exteriors, valves, flanges, bolts, nuts, structural steel, and fittings.

c. Surface Preparation (new): New metals are to arrive shop-blasted and primed with Series N140. Upon delivery, solvent clean in accordance with SSPC-SP1 Solvent Cleaning and abrasive blast or

mechanically abrade bare metals to provide an SSPC-SP10 Near-White Blast Cleaning finish.

d. Surface Preparation (existing): Abrasive blast or mechanically abrade existing metals to remove all pre-existing coatings and provide an SSPC-SP10 Near White Blast Cleaning finish with a minimum 1.5 mil angular anchor profile.

e. Prime Coat: Tnemec Series N69 at 4.0 to 8.0 mils.

f. Intermediate Coat: Tnemec Series N69 at 4.0 to 8.0 mils.

g. Finish Coat Option 1 (Immersion, Buried, or Splash/Spray Service): Tnemec Series N69 at 4.0 to 8.0 mils.

h. Finish Coat Option 2 (UV-exposed or non-immersion areas): Tnemec Series 1095 Endura-Shield at 3.0 to 5.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.

H. Submerged Concrete and Masonry Coating Systems

1. System No. 32—Exposed Concrete and Masonry, Mild to Moderate Corrosive Environment:

a. Type: Glass Flake Reinforced Modified Polyamine Epoxy (82% sbv) 1st Coat. Acrylic Polyurethane 2nd coat above the waterline, at a total dry film thickness of 16.0 to 25.0 mils.

b. Service Conditions: Concrete and masonry exposed to mild to moderate corrosive atmospheres and immersion service, such as chlorine contact basins, chlorine storage areas, or open-top (aerobic) clarifiers, aeration basins, settling basins, etc.

c. Surface Preparation: Abrasive blast or mechanically abrade in accordance with SSPC-SP13 to remove all existing coatings and provide a minimum ICRI CSP 5 surface profile.

d. Resurfacing: Apply Tnemec Series 218 to all surfaces at a minimum 1/8-inch and as needed bring all surfaces to level. For localized repairs of large bugholes, honeycombs, and other cavities deeper than the recommended maximum thickness, clean sand or pea gravel may be post-added to Series 218. If more than 1/4-inch of repairs is needed, Series 217 may be used.

e. First Coat: Tnemec Series 142, applied in multiple passes to achieve a total film build of 16.0 to 20.0 dry mils.

f. Second Coat (Above the waterline, extending down 1 foot below the waterline): Tnemec Series 1094 at 3.0 to 5.0 mils.

I. Exterior/UV-Exposed Concrete and Masonry Coating Systems

1. System No. 42—Existing or Coating Concrete and Masonry, Atmospheric Weathering Environment:

a. Type: Tnemec Series 1026 Enduratone Acrylic Emulsion (43% sbv, 100% acrylic resin) primer and finish coat with a Series 156 Enviro-Crete Modified Waterborne Acrylate (50.9% sbv) brush into hairline cracks at a total dry film thickness of 4.0 to 6.0 mils.
b. Service Conditions: Exterior concrete or masonry, exposed to ultraviolet light and weathering, which requires excellent permeance (due to existing coatings already in place).
c. Surface Preparation: Remove all loose coatings, dirt, dust, grease, oil, mold, mildew, salts, and other soluble contaminants by high-pressure water cleaning (using potable water, minimum 3,500 psi, 3–5 gallons/minute, oscillating tip). Neutralize and remove all mold and mildew using a solution made by adding 2 ounces of tri-sodium phosphate and 8 ounces of sodium hypochlorite to 1 gallon warm water. Use a scouring powder, if necessary, to remove mildew spores and then perform a final rinse with potable water. Feather edges of well-adhered preexisting coatings. No loose or lifted edges shall remain. All surfaces shall be clean, dry, and free of contaminants prior to the application of any coatings.
d. Hairline Cracks: Brush Tnemec Series 156 into hairline cracks. Multiple passes may be required for deeper cracks.
e. Prime Coat: Tnemec Series 1026 Enviro-Crete at 2.0 to 3.0 mils.
f. Finish Coat: Tnemec Series 1026 Enviro-Crete at 2.0 to 3.0 mils.

J. Nonferrous, Galvanized, and Other Miscellaneous Metals Coating Systems

1. System No. 62—Galvanized Steel, Stainless Steel, Aluminum, or Copper:

a. Type: Tnemec Series 1095 Endura-Shield Aliphatic Acrylic Polyurethane (66% sbv) finish with a Series 108 (100% sbv) prime coat at a total dry film thickness of 5.0 to 10.0 mils.
b. Service Conditions: Coat area of material using this system. Consult with coating manufacturer for immersion service requirements.
c. Surface Preparation: Clean the surface in accordance with SSPC SP-1. Primer must be applied as soon as possible on the same day as surface preparation.
d. Prime Coat: Tnemec Series 108 at 1.0 to 2.0 mils.

e. Intermediate Coat: Tnemec Series 1095 Endura-Shield at 2.0 to 44.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.
f. Finish Coat: Tnemec Series 66 at 2.0 to 4.0 mils.
g. Finish Coat: Tnemec Series 1095 Endura-Shield at 2.0 to 4.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.

2.02 PERFORMANCE CRITERIA

The following shall serve as a basis of comparison for material substitution requests. Any substitutions which decrease the total film thickness, change the generic type of coating, or fail to meet the performance criteria of the specified materials shall not be approved.

A. Series 1 Omnithane – Zinc/Micaceous Iron Oxide Urethane

1. Adhesion: ASTM D4541 (Method B, Type II) – No less than 1,433 psi (9.88 MPa) adhesion, average of three tests.
2. Salt Spray (Fog): ASTM B117 – No blistering, cracking, or delamination of film. No more than .03% rusting on plane and no more than 3/16-inch rust creepage at scribe after 10,000 hours exposure.

B. Series 22 Epoxoline – Modified Polyamine Epoxy

1. Special Qualification: Certified by NSF International in accordance with NSF 61.
2. Product must be able to be applied in one single-coat application from 16.0 to 40.0 mils dry film thickness.
3. VOC Content: 0.10 pound/gallon (12 grams/liter).
4. Immersion: ASTM 870 – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F (60°C), average of three tests.

C. Series 46H-413 Hi-Build Tneme-Tar – Polyamide Epoxy-Coal Tar

1. Adhesion: ASTM D4541 – Exceeds the cohesive strength of the concrete substrate (400 psi), average of three tests.
2. Abrasion: ASTM D4060 (CS-17 wheel, 1,000 gram load) – No more than 142 mg loss after 1,000 cycles.
3. Salt Spray (Fog): ASTM B117 – No blistering, cracking, checking, rusting, or delamination of film. No rust creepage at scribe after 9,000 hours continuous exposure.

D. Series 66 Hi-Build Epoxoline – Polyamide Epoxy

1. Adhesion: ASTM D4541 – No less than 1,930 psi (13.31 MPa) pull, average of three tests.
2. Salt Spray: ASTM B117 – No blistering, cracking, checking, or delamination of film. No more than 1/8-inch rust creepage at scribe after 8,000 hours exposure.

E. Series 90-07 Tneme-Zinc – Aromatic Zinc-Rich Urethane

1. Zinc Pigment: 83% by weight in dried film.
2. Adhesion: ASTM D4541 (Type II) – No less than 1,442 psi (9.94 MPa) adhesion, average of three tests.
3. Salt Spray: ASTM B117 – No blistering, cracking, or delamination of film. No more than 1/8-inch creepage at scribe and no more than 1% rusting on plane after 50,000 hours exposure.

F. Series 94H2O Hydro-Zinc – Zinc-Rich Aromatic Urethane

1. Special Qualification: Certified in accordance with NSF 61 for use on interior potable water tanks of 500 gallons or greater.
2. Zinc Pigment: 83% by weight in dried film.
3. Adhesion: ASTM D4541 (Type V Self-Aligning Adhesion Tester) – No less than 1,713 psi adhesion, average of three tests.
4. Salt Spray: ASTM B117 – No blistering, cracking, or delamination of film. No rusting on plane and no more than 1/16-inch rust creepage at scribe after 10,000 hours.

G. Series 104 HS Epoxy – Cycloaliphatic Amine Epoxy

1. Adhesion: ASTM D4541 – No less than 900 psi (6.21 MPa) pull, average of three tests.
2. Chemical Immersion: NACE TM0174, Procedure B – No blistering, cracking, or delamination of film after 7 days.
3. Salt Spray (Fog): ASTM B117 – No blistering, cracking, rusting, or delamination of film. No more than 1/32-inch (0.8 mm) rust creepage at scribe after 1,500 hours exposure.

H. Series 115 Uni-Bond DF – Self-Crosslinking Hydrophobic Acrylic

1. Adhesion: ASTM D4541 (Method C – Type V Tester) – No less than 1,472 psi pull (10.15 MPa), average of three tests.

2. Salt Spray: ASTM B117 – No more than 1/64-inch rust creepage at scribe, no more than 3% rusting on plane, and no less than a blister rating of 8 after 500 hours exposure.
3. Humidity: ASTM D4585/D4585M – No blistering, cracking, rusting, or delamination of film after 2,000 hours exposure.

I. Series N140 Pota-Pox Plus – Polyamidoamine Epoxy

1. Adhesion: ASTM D4541 – No less than 1,943 psi (13.40 MPa) pull, average of three tests.
2. Exterior Exposure: ASTM D1014 – No blistering, cracking, checking, rusting, or delamination of film. No rust creepage at scribe after 5 years exposure.
3. Humidity: ASTM D4585/D4585M – No blistering, cracking, or delamination of film after 10,000 hours exposure.
4. Immersion: ASTM D870 – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F, average of three tests.
5. Salt Spray (Fog): ASTM B117 (Two Coats Series N140) – No blistering, cracking, or delamination of film. No more than 1% rusting on plane. No more than 1/16-inch rust creepage at scribe after 6,700 hours exposure.
6. Salt Spray (Fog): ASTM B117 (Series 91H_2O and Two Coats Series N140) – No blistering, cracking, checking, or delamination of film. No more than 1% rusting on plane and no more than 3/16-inch rust creepage at scribe after 20,000 hours exposure.

J. Series 142 Epoxoline – Modified Polyamine Epoxy

1. Suitable for methanol immersion service.
2. Adhesion: ASTM D4541 – No less than 2,042 psi (14.08 MPa) pull, average of three tests.
3. Salt Spray (Fog): ASTM B117 – No blistering, cracking, rusting, or delamination of film and less than 1/32-inch creepage at the scribe after 5,000 hours exposure.
4. Abrasion: ASTM D4060 – No more than 59.3 mg loss after 1,000 cycles, average of two tests.

K. Series 156 Enviro-Crete – Modified Waterborne Acrylate

1. Adhesion: ASTM D7234 – Exceeds the cohesive strength of concrete substrate (400 psi), average of three tests.
2. Salt Spray: ASTM B117 – No blistering, cracking, or delamination of film. No visible damage to coating or substrate after 5,000 hours.

3. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, chalking, or delamination of the film. No less than 69% gloss retention, no more than 1.1 units gloss loss, and no more than 3.59 DE (FMC-2) color change (white) after 5,000 hours QUV exposure.
4. Fungal/Mold/Mildew Resistance: ASTM D3273 – No More than slight mold growth after 5 weeks exposure.
5. Tensile Strength, Elongation, Modulus of Elasticity: ASTM D2370 – Elongation no less than 200%, average of five tests. Tensile strength no less than 250 psi (1.7 MPa), average of three tests.
6. Wind Driven Rain Resistance: ASTM D6904 – No damage to coating or substrate. No visible moisture on the back of lightweight block after 48 hours exposure.

L. Series 239SC Chemblock – Modified Novolac Polyamine Epoxy

1. Chemical Immersion: NACE TM0174, Procedure B – No blistering, cracking, rusting, or delamination of film after 72 hours continuous contact with chemical.
2. Compressive Strength: ASTM C579 – Not less than 11,195 psi (77.19 MPa) compressive strength, average of six tests.
3. Flexural Strength and Modulus of Elasticity: ASTM D790 – Not less than 6,270 psi (43.23 MPa) flexural strength and 323,900 psi (2,233 MPa) flexural modulus of elasticity, average of five tests.
4. Impact: MIL D3134 (modified using 2.5 pound steel ball) – No more than 1/16-inch permanent indention. No cracking, checking, or delamination of film after 240 in-lb (27 J) direct impact, average of three tests.
5. Tensile Strength, Elongation, Modulus of Elasticity: ASTM D638 – No less than 7,913 psi (54.56 MPa) tensile strength, 222,975 psi (1,537 MPa) tensile modulus of elasticity and 6.14% elongation at break.

M. Series 241 Ultra-Tread MVT – Polyurethane Modified Concrete

1. Can be applied to 10-day old concrete.
2. Withstands moisture vapor transmission up to 20 pounds in accordance with ASTM F1869.
3. Withstands relative humidity up to 99% in accordance with ASTM F2170.
4. Adhesion: ASTM D7234 – Exceeds the cohesive strength of the concrete substrate (approximately 400 psi), average of three tests.
5. Compressive Strength: ASTM C579 – No less than 4,922 psi (33.94 MPa) compressive strength, average of six tests.
6. Flexural Strength and Modulus of Elasticity: ASTM C580 – No less than 2,438 psi (16.81 MPa) flexural strength and 313,614 psi (2,162 MPa) modulus of elasticity (tangent), average of five tests.

7. Tensile Strength: ASTM C307 – No less than 1,015 psi (7.00 MPa) tensile strength, average of six tests.

N. Series 248 Everthane – Aliphatic Moisture Cured Urethane

1. Chemical Resistance: Tnemec Test Method-59 (TTM-59) (ASTM D1308) (Covered Spot Test) – No blistering, cracking, checking, or delamination of film. No more than slight softening or very slight swelling and loss of gloss after 24 hours exposure to the following reagents: 30% Sulfuric Acid, 10% Hydrochloric Acid, 50% Phosphoric Acid, 10% Acetic Acid, 50% Sodium Hydroxide, 10% Ammonium Hydroxide, Methyl Ethyl Ketone, Ethyl Alcohol, Hexane, Xylene, Gasoline, Ethylene Glycol, Skydrol, Brake Fluid, Transmission Fluid, Aviation Gas, Jet Fuel (JP4).
2. Abrasion: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 18 mg loss after 1,000 cycles, average of three tests.

O. Series 282 Tneme-Glaze – Polyamine Novolac Epoxy

1. Chemical Immersion: NACE TM0174, Procedure B – No blistering, cracking, rusting, or delamination of film after 72 hours continuous contact with chemical.
2. Compressive Strength: ASTM C579 – Not less than 11,195 psi (77.19 MPa) compressive strength, average of six tests.
3. Immersion: 140°F Deionized Water Immersion – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion.
4. Impact: ASTM D2794 – No visible cracking or delamination of film after 59 in/lbs direct impact, average of three tests.
5. Salt Spray (Fog): ASTM B117 – No blistering, cracking, rusting, or delamination of film. No more than 1/16-inch rust creepage at scribe after 3,500 hours exposure.

P. Series 365 Tank Armor – Novolac Epoxy

1. Suitable for immersion service in 98% sulfuric acid.
2. Adhesion: ASTM D4541, Type II – No less than 1,650 psi (11.38 MPa) adhesion, average of three tests.
3. Hardness: ASTM D2240 (Shore D Durometer) – Not less than 90 Shore Type D hardness, average of five tests.

Q. Series 431 Perma-Shield PL – Modified Polyamine Ceramic Epoxy

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 11.18 log-Z at 0.001 Hz (ohms cm^2). No blistering, cracking, checking, or delamination. No less than 88.7% EIS retention or not more than

1.26 ohms cm² reduction in log-Z electrochemical impedance at 0.001 Hz after 28 days exposure. No less than 2,363 psi (16.30 MPa) adhesion or no loss of adhesion after 28 days in S.W.A.T., average of three tests.

2. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000 cycles, 1,000 gram load) – No more than 41 mg loss, average of three tests.
3. Abrasion Resistance: BS EN 598: 2007+A1: 2009 (Rocking Abrasion) – No more than 0.14 mm (5.5 mils) thickness of coating loss after 1,000,000 cycles.

R. Series 434 Perma-Shield H2S – Modified Aliphatic Amine Epoxy Mortar

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 10.6 log-Z at 0.01 Hz (ohms cm²). No blistering, cracking, or checking. No less than 86.7% retention or not more than 1.4 ohms cm² reduction in log-Z electrochemical impedance at 0.01 Hz after 28 days exposure.
2. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 88 mg loss after 1,000 cycles, average of three tests.
3. Impact: ASTM D2794 – No visible cracking or delamination after 160 inch-pounds (18.1 J) direct impact.
4. Compressive Strength: ASTM D695 – Not less than 12,331 psi (85.0 MPa) compressive strength, average of five tests.

S. Series 435 Perma-Glaze – Modified Polyamine Epoxy

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 12.46 log-Z at 0.01 Hz (ohms cm²). No blistering, cracking, checking, or delamination. No less than 84.3% retention and no more than 1.95 ohms cm² reduction in electrochemical impedance after 28 days exposure. No less than 93% loss of tensile adhesion after 28 days in S.W.A.T. average of three tests.
2. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 72 mg loss after 1,000 cycles, average of three tests.

T. Series 436 Perma-Shield FR – Fiber-Reinforced Modified Polyamine Epoxy

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 10.2 log-Z at 0.01 Hz (ohms cm²). No blistering, cracking, or checking. No less than 83.7% retention or not more than 1.6 ohms cm² reduction in log-Z electrochemical impedance at 0.01 Hz after 28 days exposure.
2. Abrasion: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 74.6 mg loss after 1,000 cycles, average of three tests.

3. Impact: ASTM D2794 – No visible cracking or delamination of film after 88 inch-pounds direct impact.
4. Compressive Strength: ASTM D695 – No less than 8,866 psi (6.13 MPa) compressive strength, average of five tests.

U. Series 626 Dur A Pell GS – RTV Silicone Rubber Water and Graffiti Protectant

1. Accelerated Weathering: ASTM C793 – No signs of deterioration except for dirt accumulation after 4,000 hours exposure.
2. Chloride Ion Penetration: AASHTO T-259 – No less than a 1500% reduction in the chloride ion content when compared to untreated concrete, average of two tests.

V. Series 662 Prime-A-Pell Plus – Modified Siloxane/Silane with Diffused Quartz Carbide

1. QUV Exposure: ASTM D4587 (UVA-340 bulbs, Cycle 4: 8 hours UV/4 hours condensation) – No reduction in water repellent performance after 5,000 hours exposure.
2. Water Absorption: ASTM C67/C67M (Applied to Ohio Sandstone) – No less than a 96% reduction in water absorption as compared to untreated samples following 24 hours of immersion.
3. Water Absorption: ASTM C97/C97M (Applied to Fire Clay Brick) – No less than a 93% reduction in water absorption as compared to untreated samples following 24 hours of immersion.
4. Water Absorption: ASTM C140/C140M (Applied to Cast Mortar Cubes) – No less than a 96% reduction in water absorption as compared to untreated samples following 24 hours of immersion.

W. Series 700 Hydroflon – Advanced Thermoset Solution Fluoropolymer

1. Exterior Exposure: ASTM D1014 (AAMA 2604) (South Florida Marine Exposure) – Exceeds the exterior weathering requirements of AAMA 2604 standard.
2. Exterior Exposure: ASTM D4141/D4141M, Method C (EMMAQUA) – No blistering, cracking, or chalking. No less than 100% gloss retention, no more than 1 unit gloss loss and no more than 0.23 DEHunter color change (white) after 1,500 MJ/m² (69,109MJ/m² total) EMMAQUA exposure.
3. QUV Exposure: ASTM D4587 – No blistering, cracking, or chalking. No less than 61% gloss retention (31.4 units gloss change) and 1.89 DEFMC2 (MacAdam units) color change (white) after 25,000 hours exposure.
4. Xenon Arc Weathering: ASTM D6695 – No blistering, cracking, or chalking. No less than 87% gloss retention (11.9 units gloss change) and

no greater than 0.37 DE00 color change (white) after 8,000 hours Xenon Arc exposure.

X. Series 971 Aerolon – Fluid-Applied Acrylic Insulation Coating

1. Immersion: ASTM D870 – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F (60°C), average of three tests.
2. Thermal Conductivity: ASTM C518 – Thermal conductivity shall not be greater than 0.0356 W/m-°K or 0.2468 BTU-in/ft²-hr-°F (R-value at 1 inch equals 4.1).

Y. Series 1026 Enduratone – Acrylic Emulsion

1. VOC Content: 0.38 pounds/gallon (1.4 grams/liter).
2. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, chalking, or delamination of film. No less than 49% gloss retention (2.3 units gloss change) and 0.39 DE00 color change after 10,000 hours exposure.

Z. Series 1029 Enduratone – HDP Acrylic Polymer

1. Algal Resistance: ASTM D5590 – No more than traces of fungal growth (less than 10%) after 3 weeks continuous exposure.
2. Fungal/Mold/Mildew Resistance: ASTM D5590 – No more than traces of fungal growth (less than 10%) after 4 weeks continuous exposure.
3. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, or delamination of film. No less than 100% gloss retention, no more than 0.45 DE00 color change and no unit gloss loss after 3,000 hours.

AA. Series 1095 Endura-Shield – Aliphatic Acrylic Polyurethane

1. Volatile Organic Compounds (Thinned 5%): 0.77 pounds/gallon (92 grams/liter).
2. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, or delamination. No less than 52% gloss retention or 23 units gloss change and 0.59 DECIE2000 color change (white) after 2,000 hours exposure.

PART 3 EXECUTION

3.01 WEATHER CONDITIONS

A. Do not paint in the rain, wind, snow, mist, or fog or when steel or metal surface temperatures are less than 5°F above the dew point.

B. Do not apply paint when the relative humidity is above 85% or otherwise outside the manufacturer's recommended level.

C. Do not paint when temperature of the substrate is outside of the manufacturers listed surface temperature requirement.

3.02 SURFACE PREPARATION PROCEDURES

A. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before abrasive blasting. Powerwashing with a biodegradable degreaser is also acceptable.

B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

C. Remove sharp edges, burrs, and weld spatter.

D. Do not abrasive blast or prepare more surface area in 1 day than can be coated in 1 day; prepare surfaces and apply coatings the same day. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Prime all areas before rust bloom forms and within the same day.

E. Surface preparation shall conform to the SSPC Specifications and NACE Standards as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5/NACE No. 1
Commercial Blast Cleaning	SP-6/NACE No. 3
Brush-Off Blast Cleaning	SP-7/NACE No. 3
Pickling	SP-8

Near-White Blast Cleaning	SP-10/NACE No. 2
Power Tool Cleaning to Bare Metal	SP-11
High- and Ultra-High-Pressure Water Jetting	SP-12/NACE No. 5
Surface Preparation of Concrete	SP-13/NACE No. 6
Industrial Blast Cleaning	SP-14/NACE No. 8
Waterjet Cleaning of Metals – Clean to Bare Substrate	SP WJ-1
Waterjet Cleaning of Metals – Very Thorough Cleaning	SP WJ-2
Waterjet Cleaning of Metals – Thorough Cleaning	SP WJ-3
Waterjet Cleaning of Metals – Light Cleaning	SP WJ-4

F. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning" or similar words are used in these Specifications or in the paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC, surface preparation specifications listed above.

G. Brush-off blasting of concrete and masonry surfaces is defined as opening subsurface holes and voids and etching the surface for a coating to bond.

H. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be angular and from 2.0 to 3.0 mils unless specified otherwise. Verify the surface profile by measuring with an impresser tape acceptable to the Owner's Representative. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the Owner's Representative. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the Owner's Representative.

I. Do not apply any part of a coating system before the Owner's Representative has reviewed the surface preparation. If coating has been applied without this review, if directed by the Owner's Representative, remove the applied coating by abrasive blasting and reapply the coat in accordance with this Specification.

3.03 ABRASIVE BLAST CLEANING

A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.

B. After abrasive blast cleaning and before coating is applied, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting.

C. Apply the specified primer or touch-up coating within an 8-hour working day. Do not apply coating over damp or moist surfaces. Reclean any blast-cleaned surface not coated within the 8-hour period before applying primer or touch-up coating.

D. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.

E. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating so that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.04 PREPARATION OF CONCRETE AND MASONRY SURFACES TO BE COATED

A. Surface preparation of concrete and masonry surfaces shall be in accordance with SSPC SP-13/NACE No. 6 and the following.

B. Do not apply coating until concrete has cured for at least 30 days at 750F and a minimum 50%. Do not use curing compound on surfaces that are to be coated.

C. Concrete and masonry surfaces on which coatings are to be applied shall be of even color, gray or gray-white. The surface shall have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff-bristle fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets. Concrete and masonry shall be free of laitance and slick surfaces.

D. Detergent clean the concrete or masonry surface with Trisodium Phosphate in accordance with ASTM D4258. Then abrade or blast surfaces to the required surface profile. Floor slabs may be acid etched as specified in ASTM D4260 in lieu of sandblasting. After sandblasting, wash surfaces with water to remove dust and salts in accordance with ASTM D4258 or ASTM D4261. Use ICRI standards for concrete and masonry surface preparation.

E. All concrete which has been subjected to low-pH or acidic conditions must be confirmed to have a pH of 9 or greater prior to application of coatings. If the desired surface profile has been achieved without a minimum pH of 9, that surface shall be considered contaminated and in need of further abrasion or blasting.

F. Before coating concrete, plaster, and masonry that is below-grade, on-grade, or new, determine the presence of capillary moisture in accordance with ASTM D4263, except as modified below. Tape a 4-foot-by-4-foot sheet of polyethylene plastic to the concrete surface to be coated. Allow the plastic sheet to remain in place at least 24 hours. After the specified time has elapsed, remove the plastic sheet and visually examine both the underside of the plastic sheet and

the concrete surface beneath it. There shall be no indication of moisture on either surface. If moisture is indicated, allow additional curing time for the concrete and then retest. Provide one test sheet for every 500 square feet of concrete surface to be coated. For walls, provide one test sheet for each 10 feet (or fraction thereof) of vertical rise in all elevations starting within 12 inches of the floor or base slab.

G. Acceptance criteria for concrete surfaces shall be in accordance with SSPC SP-13, Table 1, "Severe Service" or this Section, whichever is more stringent.

H. Do not apply coatings to concrete when the concrete is outgassing. Apply coatings only when the concrete surface temperature is stable or declining, not rising. Apply concrete coatings when the temperature is falling to reduce the potential of outgassing.

3.05 COATING STAINLESS STEEL, NONFERROUS, AND COPPER

A. Solvent clean in accordance with SSPC SP-1. Solvents and cleaning solutions shall contain less than 200 mg/L of halogens. Then prepare in accordance with the specified coating system.

B. All surfaces must be primed as soon as possible on the same day following surface preparation.

3.06 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

A. After applying primer to surfaces, allow coating to cure for a minimum of 2 hours before handling to minimize damage.

B. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.

C. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

D. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless the ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.07 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.

B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of Trisodium Phosphate, detergent, and water. Rinse scrubbed surfaces with clean water.

C. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by scrubbing with a stiff bristle brush.

D. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7/ NACE No. 3. Take care that the remaining primers are not damaged by the blast cleaning operation. The remaining primers shall be firmly bonded to the steel surfaces with blast-cleaned edges feathered.

E. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10/NACE No. 2. Take care that the remaining primers are not damaged by the blast cleaning operation. Areas smaller than 1 square inch may be prepared in accordance with SSPC SP-11. The remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.

F. Use repair procedures on damaged primer that protect adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.

G. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.

H. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

3.08 PAINTING SYSTEMS

A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners,

driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.

B. Deliver paints to the jobsite in the original, unopened containers.

3.09 PAINT STORAGE AND MIXING

A. Store and mix materials only in areas designated for that purpose by the Owner's Representative. The area shall be well ventilated, with precautionary measures taken to prevent fire hazards. Post "No Smoking" signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use.

B. Store paint in accordance with the manufacturer's latest written recommendations, or at an ambient temperature from 50°F to 100°F, whichever is more stringent.

C. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.10 PROCEDURES FOR THE APPLICATION OF COATINGS

A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer, including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.

B. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner before mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility in working area before applying coating. Remove dust from coated surfaces by dusting, sweeping, and vacuuming before applying succeeding coats.

E. Apply coating systems to the specified minimum dry-film thicknesses as determined in accordance with SSPC PA-2.

F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Before applying coating, re-clean surfaces that have surface colored or become moist by blast cleaning.

G. Apply a brush coat of the specified primer on welds, sharp edges, nuts, bolts, and irregular surfaces before applying the prime coat. Apply the brush coat before and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

H. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer's recommendation.

I. Each coat shall cover the surface of the preceding coat completely and there shall be a visually perceptible difference in applied shade or tint of colors.

J. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the Owner's Representative.

K. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

3.11 SURFACES NOT TO BE COATED

A. Do not paint the surfaces listed below unless otherwise noted in the drawings or in other Specification sections. Protect the following surfaces during the painting of adjacent areas:

1. Concrete walkways.
2. Mortar-coated pipe and fittings.
3. Stainless steel.

4. Metal letters.
5. Glass.
6. Roofing.
7. Fencing.
8. Electrical fixtures except for factory coatings.
9. Nameplates.
10. Grease fittings.
11. Brass and copper.
12. Buried pipe, unless specifically required in the piping specifications.
13. Fiberglass items, unless specifically required in the FRP specifications.
14. Aluminum handrail, stairs, and grating.

3.12 PROTECTION OF SURFACES NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

3.13 SURFACES TO BE COATED

A. The exact coating to be applied in any location is not designated by the descriptive phrases in the coating system titles such as “corrosive environment,” “buried metal,” or “submerged metal.” Coat surfaces with the specific coating systems as described below:

1. Coat mechanical equipment such as pumps, blowers, and clarifier mechanisms as described in the various mechanical equipment sections. The color of the finish coat shall be coordinated with the Owner.

2. Coat submerged steel piping and ductile iron piping as specified in System No. 2.

3. Coat valves as described the same as the adjacent piping. Aboveground valves, or valves in vaults and structures, shall match the color of the connecting piping. If the adjacent piping is not coated, coat valves as specified in System No. 21. Coat handwheels the same as the valves.

4. Coat floor stands as specified in System No. 21.

5. Coat concrete and masonry surfaces where shown in the Drawings and as described in this Section. Apply System No. 42 on exposed exterior concrete, System No. 32 on exposed interior concrete surfaces, and System No. 32 on submerged concrete surfaces unless otherwise shown in the Drawings.

6. Coat aluminum surfaces in contact with concrete as specified in System No. 62.

7. Coat buried flanges, nuts and bolts, washers, rods, harnesses, clamps, sleeves, valves, flexible pipe couplings, exposed rebar in thrust blocks, and valve boxes as specified in System No. 21. Coat buried bolt threads, tie bolt threads, and nuts as specified in System No. 21. Coat buried cast iron pieces as specified in System No. 21.

8. Coat aboveground structural steel or structural steel located in vaults and structures as specified in System No. 21. Color of finish coat shall be coordinated with the Owner via submittal.

9. Coat flashing and sheet metal in accordance with System No. 62. Color of finish coat shall be coordinated with the Owner via submittal.

10. Coating Schedule:

Surface or Item	**Coating System No.**
Exposed ferrous piping	21
Submerged ferrous piping	21
Exposed ferrous valves	21
Buried valves	21
Submerged valves	21
Exposed interior concrete surfaces	32
Exposed exterior concrete surfaces	42
Submerged concrete surfaces	32
Interior masonry surfaces	32
Exterior masonry surfaces	42
Aboveground structural steel	21

3.14 DRY-FILM THICKNESS TESTING

A. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Measure coating thickness specified for stainless steel, aluminum, and copper surfaces with an eddy-current type thickness gauge in accordance with ASTM D7091. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.

B. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide detector as manufactured by Tinker and Rasor, K-D Bird Dog, or similar. Test using voltages recommended by the coating manufacturer.

C. If the Owner's representative suspects low film thickness, the coating thickness for concrete or masonry surfaces may be measured in accordance with ASTM D4138 (tooke gauge). Use of a "tooke" gauge is classified as a destructive test. Before performing any destructive tests on a newly applied coating system, the Owner and Contractor shall determine which of them is responsible for the cost of repairing the damaged coatings.

D. For severe environments, test the finish coat of concrete and masonry surfaces in accordance with NACE SP0188 or ASTM D4787. Patch coatings at the points of thickness measurement or holiday detection.

E. Check each coat for the correct dry-film thickness. Do not measure within 8 hours after application of the coating.

F. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80% nor more than 120% of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.

G. Perform tests in the presence of the Owner's Representative.

3.15 REPAIR OF IMPROPERLY COATED SURFACES

A. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish the coat in accordance with the Specifications. The work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.16 CLEANING

A. During the work, remove discarded materials, rubbish, cans, and rags at the end of each day's work.

B. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.

C. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

END OF SECTION

DIVISION 11

EQUIPMENT

SECTION 11000
GENERAL EQUIPMENT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies general work requirements regarding the products and execution services that are specified in the Division 11 Sections incorporated in the Contract Documents. The requirements specified shall apply to all of the Division 11 Sections, unless noted otherwise.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. The submittal contents for equipment, instrumentation, controls, and appurtenances specified in the Division 11 Sections shall contain the general information listed below. Additional submittal requirements are contained in the Division 11 Sections.

1. A list and description of all deviations from the Contract Documents.
2. A list of equipment and components on each drawing with each product identified by legend reference. Include product name, manufacturer, and model number.
3. Completely dimensioned plans, elevations, and cross-sections of system equipment and sub-assemblies.
4. Shop and erection drawings showing details, anchor bolt locations, and field connections.
5. Manufacturers' equipment installation instructions.
6. Descriptive literature, technical bulletins, and catalog data sheets for all equipment and purchased sub-components.
7. Installation, operation, maintenance and start-up procedures.
8. Total equipment weight (while operating).
9. Drive mechanism torque rating and bearing life rating.
10. Motor data and catalog information.
11. Submit complete electrical drawings, schematics, and interconnecting wiring diagrams and schedules for the equipment control system, instrumentation, and control panel(s) showing numbered wiring terminals in the control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.

12. Control panel construction and panel layout drawings.
13. Complete technical literature for all factory-applied paint systems. Clearly indicate the components to be coated and the corresponding paint system.
14. Manufacturers' descriptive literature, product specifications, and published details.

1.03 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: The Contractor shall comply with construction requirements of State, County, and other local political subdivision specifications as may exceed the requirements of the codes, standards, and approving bodies referenced in this Section.

1. NFPA Standards: The Contractor shall comply with requirements of the National Fire Protection Association (NFPA) Standards referenced in the various Specifications Sections and as directly appropriate to the work and workmanship.
2. Electrical Requirements: The Contractor shall comply with requirements for both the Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals and the NEMA Stamps or Seals as applicable to electrical equipment or apparatus forming parts of the Mechanical Equipment.

B. Certificates and Permits: Upon completion of work and before final payment, the Contractor shall furnish to the Engineer formal certification of final inspections from authorities having jurisdiction over the work in this project and secure required permits, if any, from such authorities. Additionally, the Contractor shall prepare any detailed diagrams and drawings that are required by those authorities having jurisdiction over the work of this project at no additional cost to the Owner.

C. Source Quality Control: Products used throughout these Specifications and as indicated on the Drawings shall be from companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified. Such products may be of their own make or products of others for which they assume full responsibility when used in finished products which are not manufactured completely by them and with replacement parts available.

D. Products: The equipment specified in the Division 11 Sections was based on the latest models that were available from the specified equipment manufacturers at the time the Contract Documents were developed. If any equipment models specified in the Division 11 Sections have been discontinued or will be discontinued within 1 year after the bid date, the Contractor shall furnish and install the latest and most recent equipment model at no additional cost to the Owner.

E. For each category of materials and equipment (Products) specified in the Division 11 Sections, the Contractor shall provide Products of the same manufacturer and type.

F. Equipment Selection: The Contractor may furnish equipment of higher electrical characteristics, physical dimensions, capacities, and ratings provided such proposed equipment is approved by the Engineer in writing. Upon receiving the Engineer's approval to provide such equipment, the Contractor shall furnish the connecting mechanical and electrical services including but not limited to circuit breakers, conduit, increased control panel enclosure size, motors, bases, and any other electrical equipment needed to accommodate the higher electrical characteristics at no additional cost to the Owner.

G. If minimum energy ratings or efficiencies of equipment are specified in Division 11, Equipment, the Contractor shall furnish and install equipment that meets or exceeds the specified design and commissioning requirements (no exceptions) as determined by the Engineer.

H. All the equipment specified in the Contract Documents shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.

1.04 QUALIFICATIONS

A. The manufacturer of each piece of equipment described in the Division 11 Sections shall meet the following requirements, unless noted otherwise:

1. Have a record of operation, manufacturing and servicing the items specified in the Division 11 Sections for a minimum of 10 years before the Bid Date.
2. Have a minimum of five installations of equipment similar to that specified in this Section at municipal wastewater treatment facilities in Florida before the bid date.
3. Have been in business for at least the 10 consecutive years before the Bid Date.

B. If the equipment manufacturer that the Contractor proposes to furnish and install the equipment described in the Division 11 Sections does not meet these qualifications and is not specified in the Contract Documents, the Engineer reserves the right to reject the equipment from this manufacturer for use on this

project. Any costs incurred by the Contractor as a result of providing equipment from a manufacturer that does not meet the qualifications described in this Section shall not be incurred by the Owner.

C. The Contractor shall furnish documentation that the manufacturer meets these qualifications as part of the submittals specified in Section 01330, Submittals and Acceptance.

1.05 MAINTENANCE

A. Spare Parts

1. The Contractor shall furnish the spare parts specified in the Division 11 Sections. The Contractor shall also submit a list of recommended spare parts, special tools, and lubricants for each equipment item. The list shall include contact information for local sources for supply of all parts and professional service.

1.06 OPERATION AND MAINTENANCE (O&M) MANUALS

A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 MOTORS

A. All motors identified in Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Division 16, Electrical.

2.02 CONTROLS

A. General

1. All control panels specified in the Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Division 16, Electrical.

2. The Contractor shall furnish and install controls designed to operate on 120-volt, single-phase, 60 Hertz electric service unless otherwise specified. The Contractor shall furnish and install 120-volt step-down voltage transformers as specified in Division 16, Electrical, in each control panel as required.

3. The Contractor shall furnish and install elapsed time meters in each control panel for each piece of motor-driven equipment being controlled by that control panel. All elapsed-time meters shall be furnished and installed in accordance with Division 16, Electrical.

4. All control panels shall be furnished with a main circuit breaker to enable/disable electric service to the panelboard.

5. All control panels that will annunciate a local and/or remote alarm shall be furnished with an ALARM ACKNOWLEDGE reset pushbutton switch (momentary contact) wired to each alarm contact.

6. All indicating lamps in each control panel shall be furnished in accordance with the color-coded scheme:

   a. ON indicating lamps: Green.
   b. OFF indicating lamps: Red.
   c. Alarm indicating lamps: Amber.
   d. POWER ON indicating lamp: White.

7. Provide a heater inside of each control panel enclosure to prevent condensation. Heater size shall be in accordance with the equipment manufacturer's recommendations.

8. The face of each control panel shall be installed so it is facing north whenever possible, or provided with a sunshield when not possible.

2.03 EQUIPMENT ANCHORING SYSTEMS

A. All anchoring systems including, but not limited to, expansion anchors, adhesive anchors, anchor bolts, cinch anchors, and screws that are required to install the equipment and appurtenances specified in the Division 11 Sections shall be AISI Type 316 stainless steel unless noted otherwise.

2.04 EQUIPMENT NAMEPLATES

A. The Contractor shall provide engraved laminated phenolic nameplates with white legend and black field that provides the following information for each piece of equipment described in the Division 11 Sections.

1. Equipment Description (i.e., Screw Pump No. 1, Screw Pump No. 2, and Screw Pump No. 3).
2. Equipment Identification Label No.

B. Letter height on each nameplate shall not be less than 3/4-inch. Nameplates shall be factory drilled for fasteners. Secure nameplates to equipment or nearby wall using AISI Type 304 stainless steel fasteners. The locations of each nameplate shall be coordinated with the Owner and approved by the Owner before their installation.

C. The Contractor shall obtain the Engineer's approval for the nameplate information for each equipment item described in the Division 11 Sections before ordering these nameplates from the manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: The Contractor shall install the equipment in accordance with the manufacturer's instructions and recommendations and approved submittals at the locations shown on the Drawings. If the equipment locations shown on the Drawings are in conflict with the manufacturer's recommendations or will interfere with the installation or operation of any other item indicated in the Contract Documents, the Contractor shall relocate this equipment and provide the necessary appurtenances to install the equipment in accordance with the manufacturer's recommendations at no additional cost to the Owner. The Contractor shall not install any equipment at locations not in accordance with the Contract Documents or approved submittals.

B. The Contractor shall install equipment, slabs, walls level and plumb, parallel and perpendicular to other building and components in exposed interior spaces, unless otherwise shown on the Drawings.

C. The Contractor shall apply an anti-seize compound to threaded fasteners of equipment components that require removal, replacement, or adjustment as part of any maintenance or inspection procedure.

D. The Contractor shall furnish and install the required oil and grease for initial operation in accordance with the manufacturer's recommendations.

E. Provide means of oil lubrication for bearings and other metallic parts in sliding contact. Use alemite industrial-type fittings except where otherwise specified. The Contractor shall also perform the following work:

1. Locate lubrication points on equipment readily accessible without the necessity of removing covers, plates, housings or guards, or without creating safety hazards at installed equipment elevations.

2. The Contractor shall exhaust pressure-lubricated units to the atmosphere to prevent excessive greasing.
3. The Contractor shall extend grease fittings to locations that are readily accessible to the Owner. The Contractor shall coordinate the location of these grease fittings with the Owner before their installation.

F. The Contractor shall furnish and apply touch-up paint to any equipment's factory painting finish that is chipped or damaged during installation. All factory-finish touch-up paint shall be mutually compatible with the factory finish on the equipment and shall be furnished by the manufacturer of the equipment to be touched up in the field.

G. If equipment mounting heights are not shown on the Drawings, the Contractor shall install that piece of equipment to provide the maximum amount of headroom (defined as the distance from the bottom of the structure to the top of finished floor or grade), as possible. In such an instance, the Contractor shall obtain the Engineer's approval for this mounting location before installing that piece of equipment in the field.

H. The Contractor shall furnish and install all mechanical equipment to facilitate service, maintenance, and repair or replacement of the equipment components. The Contractor shall connect equipment for ease of disconnecting, with minimum interference to other installations.

3.02 FIELD TESTING

A. General: The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and startup tests as specified in the Division 11 Sections and the final mechanical performance test specified in this Section. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Engineer approves their use for this project. The Contractor shall refer to the Division 11 Sections regarding equipment shop testing requirements.

B. The Contractor shall adhere to the following requirements regarding the field testing to be provided for this project:

1. The service representative shall be employed by the manufacturer of the equipment specified at the time field testing is being performed. The service representative shall be authorized by the factory to perform the field testing specified in Division 11, Equipment. Upon request by the Engineer, the Contractor shall submit a letter from a company officer of

the equipment manufacturer stating that the service representative performing the field testing is authorized by the manufacturer.

2. Before scheduling each field test with the equipment manufacturer, the Contractor shall coordinate with the Owner and Engineer to obtain a list of dates that both parties would be available to attend the testing. The Contractor shall notify the Owner and Engineer of the field testing dates no less than 14 calendar days before the date of the field test.
3. If directed by the Engineer, the Contractor shall perform a second pre-startup and/or startup test, in accordance with the procedures specified in the Division 11 Sections, at no additional cost to the Owner if the original pre-startup and/or startup test did not pass because of any work that was deemed by the Engineer to be non-compliant with the Contract Documents and/or manufacturer's recommendations.
4. The Contractor shall only perform startup testing after the Contractor has reached Substantial Completion for the project as defined in the Agreement and General Conditions.
5. The Contractor shall furnish, install, and remove any temporary piping, valves, appurtenances, and equipment necessary to perform the pre-startup and startup testing to the Engineer's satisfaction.
6. All field testing shall be performed Monday through Friday at the project site, unless otherwise approved by the Owner.
7. The duration that the manufacturer's representative is required to be onsite to perform the pre-startup and startup training is specified in the Division 11 Sections.

C. Operating Costs

1. Costs for Pre-startup and Startup Testing: The Contractor shall include in the Contract Price the following operating costs for satisfactorily completing the Initial Mechanical Performance Tests on equipment being tested:

    a. Lubricating grease.
    b. Lubricating oils.
    c. Such other materials or utilities not specifically identified in this Section, but required to conduct the pre-startup and startup testing.

D. The intent of the field testing for each equipment item specified in the Division 11 Sections is provided in this Section. If the individual equipment field testing procedures specified in the Division 11 Sections are not sufficient to obtain a Manufacturer's Certification or to demonstrate compliance with the Contract

Documents, the Contractor shall perform these additional field test procedures at no additional cost to the Owner.

1. Pre-startup Testing: Upon the Contractor's completion of the installation and adjustment of the equipment; the Contractor, with his own forces and with the manufacturer's representative(s), shall demonstrate to the Engineer's satisfaction that the equipment has been furnished and installed in accordance with the Contract Documents and the manufacturer's recommendations.

    a. The Contractor shall repair any equipment items that do not pass the pre-startup test, as identified by the Engineer and/or manufacturer's representative, to the satisfaction of the Engineer before performing the startup testing for that equipment.

2. Startup Testing: Upon successful completion of the pre-startup testing, the Contractor shall demonstrate that the mechanical performance and controls of each equipment item, when operated in accordance with the design intent indicated by the Contract Documents, are satisfactory to the Owner and Engineer.

    a. Startup testing shall be performed with each equipment item and associated treatment structure simulated under similar operating conditions as the final mechanical performance testing specified in this Section. For equipment that will operate while being submerged as shown on the Drawings, the Contractor shall fill the respective treatment structure to its maximum water surface with reclaimed water for wastewater systems or potable water for water systems and perform startup testing while that equipment is submerged. The Contractor shall not use wastewater to fill any treatment structures for startup testing.
    b. After the startup testing procedures specified in the Division 11 Sections have been completed to the satisfaction of the Engineer, the Contractor shall operate that equipment for one successful continuous 72-hour period without assistance from the Owner as a condition of startup testing. If the equipment needs to be taken out of service for repair during this 72-hour period because it not operating in accordance with the intent of the Contract Documents, this operating period shall cease. A new operating period will not begin until the equipment has been operating in accordance with the Contract Documents and manufacturer's recommendations for at least 72 consecutive hours. The Contractor shall furnish any additional supervision or provisions necessary to verify that each

equipment item was successfully operated during this 72-hour operating period.

c. Upon completion of the startup test, the Contractor shall dewater each treatment and storage structure in accordance with local and State regulations and in a manner that is satisfactory to the Owner and Engineer.

3. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing of the equipment specified in the Division 11 Sections once the following conditions have been satisfied:

   a. The Contractor has successfully completed the pre-startup and startup testing requirements specified in the Division 11 Sections.

   b. The Contractor has performed the training services specified in this Section.

   c. The Contractor has procured all of the required permits for each building and treatment structure within the project site.

   d. The Engineer has received and approved all of the manufacturer's certifications of compliance, warranties, and O&M manuals for all required items as specified in the Contract Documents.

   e. The intent of the final mechanical performance test is for the entire facility to be operated by the Owner for a continuous 30-day period while the facility is receiving and treating raw sewage or raw water. During this 30-day testing period the Contractor shall furnish personnel who shall be on-site as needed and available at all times 24 hours per day during the final mechanical performance test. Personnel shall be competent in the troubleshooting and repair of the equipment and related electrical and mechanical systems specified in the Contract Documents. The Contractor's electricians and mechanical technicians shall be on-site as needed (minimum 8 hours/week) and available 24 hours per day to assist with this testing. If the final mechanical performance testing needs to be stopped and suspended due to equipment not operating in accordance with the design intent of the Contract Documents as determined by the Engineer, the following conditions shall apply:

      (1) The Contractor shall repair and troubleshoot these items immediately at no additional cost to the Owner.
      (2) The 30-day period for the final mechanical performance testing will start over (i.e., be reset to zero hours).

f. Upon restarting the final mechanical performance testing, the Contractor shall furnish the appropriate personnel defined above on-site as needed and available (minimum 8 hours/week) for 24 hours per day during the 30-day period at no additional cost to the Owner even though the total duration of the final mechanical performance testing (including restarts), may exceed 30 days.

g. The final mechanical performance test shall end when the Engineer determines that all of the equipment and related systems are operating in accordance with the design intent of the Contract Documents and all deficiencies that hinder the normal day-to-day operation of the facility have been corrected to the satisfaction of the Engineer. The Engineer shall notify the Contractor in writing when the final mechanical performance testing has been successfully completed.

3.03 TRAINING SERVICES

A. Upon completion of the pre-startup and startup testing and before the final mechanical performance testing, the manufacturer of the equipment specified in the Division 11 and 15 Sections shall provide an authorized representative to train the Owner's personnel in the operation and maintenance of the equipment. The representative shall provide additional onsite startup and troubleshooting services during this training upon request by the Engineer or Owner while performing these training services. The duration of the training services for each equipment item are specified in the Division 11 Sections.

3.04 MANUFACTURER'S CERTIFICATIONS OF COMPLIANCE

A. Upon successful completion of the pre-startup testing, startup testing, and training services specified in this Section, the Contractor shall obtain the equipment manufacturer's certification that the equipment specified in the respective Division 11 Sections has been installed, adjusted, and tested in accordance with the manufacturer's recommendations. The Contractor shall furnish the Engineer with Manufacturer's Certificates of Compliance and Equipment Manufacturer's Certificate of Installation Testing and Instruction for each specified equipment item before performing the final mechanical performance testing specified in this Section.

MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

_____ Installed in accordance with Manufacturer's recommendations.

_____ Inspected, checked, and adjusted.

_____ Serviced with proper initial lubricants.

_____ Electrical and mechanical connection meet quality and safety standards.

_____ All applicable safety equipment has been properly installed.

_____ System has been performance tested, and meets or exceeds specified performance requirements (when complete system of one manufacturer).

Comments: _____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment, and (iii) authorize the make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Manufacturer: _____

By Manufacturer's Authorized Representative: _____
(Authorized Signature)

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION TESTING AND INSTRUCTION

OWNER City of Clearwater

PROJECT East WRF Screw Pump Replacement

CONTRACT NO. 22-0028-UT

Jones Edmunds No. 03720-062-01

EQUIPMENT SPECIFICATION SECTION _____

EQUIPMENT DESCRIPTION _____

I _____, Authorized representative of
(Print Name)

_____
(Print Manufacturer's Name)

hereby CERTIFY that _____
(Print equipment name and model with Serial No.)

Installed for the subject project has have been installed in a satisfactory manner, has have been satisfactorily tested, is/are ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the units on Date:

_____ Time: _____.

CERTIFIED BY: _____ DATE: _____
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGEMENT OF MANUFACTURER'S INSTRUCTION

I/We the undersigned, authorized representatives of the _____ and/or Plant Operating Personnel have received classroom and hands on instruction on the operation, lubrication, and maintenance of the subject equipment and am/are prepared to assume normal operational responsibility for the equipment:

_____ DATE: _____

_____ DATE: _____

_____ DATE: _____

END OF SECTION

SECTION 11282
FABRICATED GATES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section shall only be applicable to the Contract Documents for reference in refurbishing the slide gate components or in the event that the Owner elects the Deductive Bid Alternate for Slide Gate Replacement as defined in Section 01200, Measurement and Payment. The Contractor is responsible for field-verifying all existing gate components, dimensions, and operation to ensure the refurbished or replaced product meets or exceeds the field conditions.

B. Furnish all labor, materials, and incidentals required to provide the fabricated gates specified herein as well as shown on the Drawings. The fabricated gates for this project include, but are not limited to:

1. Aluminum slide gates. The gates and appurtenances shall be supplied in accordance with the latest edition of AWWA C562 as modified herein. The allowable leakage rate for the aluminum gates in this specification shall be in accordance with the allowable leakage listed in the latest revision of AWWA C562.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Complete description of all materials including the material thickness of all structural components of the frame and slide.

C. Installation drawings showing all details of construction, details required for installation, dimensions, weights, and anchor bolt sizes, hole depths and locations.

D. Maximum bending stress and deflection of the gate and channels under the maximum design head.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of

this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

1. AISI 410—Stainless Steel.
2. AISI 416—Stainless Steel plus Related Metals.
3. AISI 4142—Heat Treated Steel Specifications.

B. American Society for Testing and Materials (ASTM)

1. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
2. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
3. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes.
4. ASTM A380/A380M—Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
5. ASTM B209/B209M—Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
6. ASTM B308/B308M—Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
7. ASTM D3935—Standard Classification System and Basis for Specification for Polycarbonate (PC) Unfilled and Reinforced Material.

C. American Society of Mechanical Engineers (ASME)

1. ASME Section IX—Welding and Brazing Qualifications.

D. American Welding Society (AWS)

1. ANSI/AWS D1.1—Structural Welding Code-Steel.

E. American Water Works Association (AWWA)

1. AWWA C562—Fabricated Aluminum Slide Gates.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with Section 11000, General Equipment Requirements.

1.05 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplemental General Conditions, and Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storage and protection of the items specified in this Section.

1.07 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified in this Section shall meet the qualifications specified in Section 11000, General Equipment Requirements.

1.08 OPERATIONS & MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with General Conditions, Supplemental General Conditions, and Section 01830, Operations and Maintenance Manuals.

1.09 SPECIAL DESIGN CONSIDERATIONS

A. All of the fabricated gates and appurtenances specified in this Section shall be furnished by a single manufacturer.

B. The Contractor shall be responsible for determining the actual cutout dimensions required for each embedded fabricated gate frame before coordinating any modifications needed to the concrete walls, decks, and slabs around each frame.

C. Fabricated Gate Materials

1. All furnished fabricated gates immersed or directly exposed to wastewater shall be suitable for long-term exposure to wastewater and produced gases and by-products.
2. The gates shall be designed and constructed to operate outdoors in a non-covered or enclosed, corrosive area containing hydrogen sulfide and other compounds commonly found in wastewater treatment facilities.

D. The Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances. Quantity and location shall be determined by the gate

manufacturer. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts. Anchor bolts shall have a minimum diameter of 1/2 inch.

E. The Contractor shall verify with the fabricated gate manufacturer that all fabricated gates of sufficient width and height function as intended as determined in the field upon Contractor verification.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. Equipment Identification Labels

1. As determined in the field upon Contractor verification.

B. Performance Requirements: The leakage from slide gates in the fully closed position shall not exceed the following:

1. 0.05 gpm per foot around the wetted gate perimeter when subjected to the design seating head (measured from the gate invert).
2. 0.05 gpm per foot around the wetted gate perimeter when subjected to the design unseating head (measured from the gate invert).

C. General Design Conditions

1. As determined in the field upon Contractor verification.

D. Acceptable Manufacturers

1. Waterman Valve LLC.
2. Engineer-approved equal.

2.02 EQUIPMENT

A. General: The fabricated gates specified in this Section shall be used to isolate or control the rate of flow from one channel or unit process basin to another by lowering or raising a plate from a gate operator located above the operating floor. The slide gates specified in this Section shall be of the upward-opening type that shall close when the plate is lowered into the flow channel or basin.

B. Materials: The specifications herein below shall apply to each fabricated gate specified in this Section.

1. Plate: The gate plate shall consist of a flat plate reinforced with structural or formed members welded to the plate with structural shapes extrusions welded to the plate as required. The extrusions shall be of the same material as the plate. The reinforcing members shall be of the same material as the plate. Each plate shall be a minimum thickness of 1/2-inch where the plate engages the slides and be designed to limit deflection of the plate to 1/720 of its span, or 1/16-inch, whichever is less, when subjected to the design conditions as confirmed in the field. All plate components shall have a minimum material thickness of 1/4 inch. Working stresses shall not exceed 50% of the material's yield strength or 25% of the material's ultimate strength, whichever is less.

2. Frame: The gate frame shall consist of guides, an invert member, and operator yoke welded or bolted together to form a rigid one-piece frame. Each frame shall be furnished with guides that are of "sandwiched" type construction and built-up of plates, angles, and formed shapes in full accordance with the latest AWWA standards. Yoke members to be designed to limit the deflection to 1/360 of its span or 1/8 inch, whichever is less, and shall be arranged to permit removing the plate from the frame.

a. General

(1) Self-contained Frames: The frame assembly for fabricated slide gates furnished with self-contained frames shall extend out of the gate opening, to at least above the full height of the disk in the "open" position. The yoke to support the gate operator operating shall be formed by angles welded at the top of the guides to provide a one-piece rigid frame. The arrangement of the yoke will be such that the plate and stem can be removed without disconnecting the yoke. The yoke members shall be designed for the maximum output of the gate hoist.

(2) Embedded Frames: Each fabricated gate to be mounted within a flow channel (guide slots recessed in the concrete walls on the seating and unseating side of the gate) shall be furnished with an embedded frame assembly suitable for installing the fabricated gate in the flow channel. The invert of embedded unit frames shall have an angle welded to the lower ends of the guides to incorporate a flush bottom seal that is attached to the bottom of the frame invert. Seals

attached to the plate are not acceptable. All seats and seals shall be mechanically fastened and field replaceable.

(3) Wall-Mounted Frame: Each fabricated gate to be wall-mounted shall be furnished with a frame assembly suitable for mounting the fabricated gate to the concrete surfaces at the end of the flow channel or wall opening. All wall-mounted or wall thimble-mounted gates shall have a flange frame. Flat-frame gates are not acceptable.

b. Slide Gates: The frame assembly for slide gates shall be furnished with an invert structural member or formed shape welded to the bottom of the frame to form a flush surface and to meet with the plate seal. A specially molded resilient seal shall be mounted on the bottom of the plate to provide a flush-bottom closure. The shape of the slide mounted seals shall produce a seating surface having a minimum width of 3/4 inch, and the seal will extend into the secondary slot of the guide. The vertical face of the seal shall be in contact with the seating surface of the guide to provide a proper seal at the corners. Alternately, the flush bottom seal can be mounted to the frame invert.

3. Guides: Each side of the gate frame shall be furnished with slotted guide slots that shall overlap both sides of the plate by at least 3/4 inch and allow the plate to travel in the vertical direction.

a. Each fabricated gate shall be furnished with ultra-high molecular weight polymer (UHMWPE) strips securely attached by mechanical fasteners in the guide in the guide to provide a low-friction surface on which the plate will slide. The guide shall be designed for maximum rigidity and shall be provided with keyways to lock it into the concrete. The invert of the frame The invert of the frame on upward opening gates shall be a structural member welded to the lower ends of the guides to form a mounting surface for the flush-bottom resilient seal.

b. For self-contained frames, the guides extending above the operating floor shall be sufficiently strong to be free-standing so that no further reinforcing will be required. Guides shall be sufficiently rigid to handle wind loads when the slide is in its highest travel position. The yoke to support the operating bench stand for standard frames shall be formed by two angles or channels welded at the top of the guides to provide a one-piece rigid frame. The arrangement of the yoke shall be such that the plate and stem can be removed without disconnecting the yoke. The design of the yoke shall be such to limit its deflection to 1/360

of its span or 1/18-inch, whichever is less, under full operating load.

c. The guide shall have weight of not less than 3 pounds per foot and will be provided with holes for anchor bolts at a maximum of 12 inches for wall-mounted frames or embedded keyways for embedded frames.

d. Guides shall extend beneath the channel or basin opening a sufficient amount to support the plate in the fully open position for downward opening gates and shall extend above the channel to support the full height of the plate when the gate is in the fully open position.

4. Stems: Each fabricated gate shall be of the rising-stem type and shall be furnished with a stem extending from the yoke to the top of the gate plate at its lowest operating elevation. Each stem shall be ASTM A276/A276M Type 316/316L stainless steel. Each gate stem shall be designed to withstand twice the force transmitted to the gate plate from an 80-lb pull on the gate operator when subjected to the design head conditions in Gate Schedule on the Drawing and elsewhere in the Drawings. Stems shall be cut-threaded or rolled-threaded with full depth threads and threaded adequately to provide full travel of the gate plate. Stem threads shall be polished to a 16-microinch finish. The stem length/stem radius (L/r) ratio of the unsupported stem segment shall not exceed 200.

5. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.

6. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.

7. The threaded portion of the stem shall have machine rolled threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.

8. Stems, on manually operated gates, shall be provided with adjustable stop collars to prevent over closing of the slide.

   a. Stem Guides: Stem guides shall be furnished as needed to limit the unsupported stem length to the specified L/r ratio.

   b. Stem Covers: Each fabricated gate shall be furnished with a stem cover to indicate the gate position (open/closed), permit inspection of the stem threads, and protect the stem from contamination. The stem cover material shall be clear polycarbonate meeting ASTM D3935 standards. Vent holes shall be provided in each stem

cover to prevent condensation and a stem cap shall be provided at the top of the stem cover. Each stem cover shall be furnished with a clear mylar position-indicating marking tape. The marking tape shall be adhesively backed and shall be permanently marked and calibrated in feet and inches.

c. Stem Couplings: Stem couplings, if needed, shall be fabricated from ASTM A276/A276M Type 316/316L stainless steel and shall be threaded and keyed to ensure a true and stable connection.

9. Gate Operators:

a. General: The operators for each gate shall consist of a hoist connected to the stem. Each hoist shall be operated with by handwheel or motorized actuator with manual bypass as noted on the Gate Schedule in the Drawings to raise or lower each fabricated gate as needed.

(1) All gate operators shall be designed for manual operation unless noted otherwise in the Gate Schedule in the Drawings.
(2) All gate operators shall be located at a height of 42 inches above the operating platform elevation, unless noted otherwise in Gate Schedule in the Drawings.
(3) All crank operated hoists shall be geared and shall have a weatherproof cast iron or cast aluminum housing or pedestal with a 2-inch bronze operating nut.
(4) Operators shall be grease lubricated and provided with grease fittings at readily accessible locations.
(5) The bench stand or floor stand hoists for standard frames shall be sized to permit operation of each fabricated gate subjected to the design head condition specified in the Gate Schedule in the Drawings, with a maximum 80-pound pull on the crank or handwheel.
(6) All gates having widths greater than two times their height shall be provided with two lifting devices connected by a tandem shaft for simultaneous operation.
(7) Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
(8) Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
(9) Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.

(10) Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.

(11) The crank shall be removable.

b. Hoist: Each hoist shall be furnished with thrust bearings, bronze hoist nuts and an internally threaded bronze stop nut to limit the downward travel of the stem and slide. All hoist nuts shall be manganese bronze conforming to ASTM B584 C86500. The hoist nut shall be supported on roller bearings. A lubrication fitting shall be provided for lubrication of hoist bearings without disassembly of the hoist. Suitable seals shall be provided to prevent entry of foreign matter. The direction of handwheel or crank rotation to open the gate shall be clearly and permanently marked on the hoist.

c. Remote Drive Assembly: Each fabricated gate that has a normal yoke elevation higher than 42 inches above the top of the operating platform elevation shall be furnished with a remote drive assembly mounted to the frame as specified on the Gate Schedule in the Drawings. The remote drive assembly shall consist of a geared lift coupled to a 90-degree bevel gear box by means of a floating shaft and lovejoy couplings. This gear box shall be mounted on the edge of the self-contained yoke. A second gear box shall be placed 42 inches above the structure and connected by means of a shaft and couplings. All shafts and couplings shall be AISI Type 316 stainless steel and aligned to acceptable coupling tolerance. The cast iron or cast aluminum gear box. Cast iron housing shall be epoxy coated in accordance with Section 09900, Painting and Coating.

d. Chain wheels are not acceptable.

e. Cranks: Crank operators where specified shall be self-locking at any position of stem travel. Cranks shall be cast aluminum or Type 316/316L stainless steel. Cranks shall be no less than 12 inches long and shall be keyed to the operating nut.

10. Seals: Provide seals with a self-adjusting seal system to restrict leakage in the guides of each frame to allow each fabricated gate to meet the performance requirements specified in this Section when subjected to the design head conditions in the Gate Schedule on the Drawings.

a. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the

frame and slide. Gates that utilize rubber "J" seals or "P" seals are not acceptable. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.

b. The seal system shall have been factory tested to confirm negligible wear (less than 0.01 inch) and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

c. Bottom Seals: Each fabricated gate shall be furnished with an extruded resilient neoprene seal mounted on the bottom of the plate or into the invert member to provide flush-bottom closure. For slide mounted seals, the shape of the seal shall produce a seating surface with a minimum width of 3/4 inch. The seal shall be designed to extend into the secondary slot of the guide and the vertical face of the seal shall contact the seating surface of the guide to provide a proper seal at the corners.

C. Aluminum Fabricated Gates

1. General: The specifications herein below shall apply to the aluminum fabricated gate components specified in this Section.

2. Materials: Each aluminum fabricated gate shall be fabricated from the following materials:

   a. Plate: The plate shall be Aluminum ASTM B209/B209M 6061-T6. Plate stiffeners shall be Aluminum ASTM B308/B308M 6061-T6.
   b. Frame, Guides and Yoke: Aluminum ASTM B308/B308M 6061-T6.
   c. Thrust Nut: Aluminum B26-356.

3. Stem Guides: Stem guides, where required to limit the unsupported stem length, shall be cast or fabricated aluminum with polymer bushings. The stem shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

2.03 EQUIPMENT LABELS

A. General

1. Furnish a 1-1/2-inch-minimum-diameter stainless-steel tag for each fabricated gate. Use block-type numbers and letters with 1/4-inch-minimum high numbers and letters stamped on and filled with black enamel. Each tag shall bear the equipment identification label shown in the Gate Schedule on the Drawings.
2. Attach the tag to the operator by soldered split key rings so that the ring and tag cannot be removed. Alternately, permanently fasten the tag to the gate with rivets or stainless steel screws. No adhesives shall be permitted.

PART 3 EXECUTION

3.01 INSTALLATION

A. All fabricated gates shall be thoroughly cleaned and installed in strict conformance with the manufacturer's recommendations prior to installation. Stem threads shall be cleaned and coated with an anti-galling compound prior to installation.

B. The Contractor shall install the equipment specified herein in accordance with Section 11000, General Equipment Requirements.

C. Fabricated gate components shall be machined and/or adjusted as needed to meet the design tolerances specified in this Section and recommended by the manufacturer.

D. Install the equipment in the locations as shown on the Drawings and in accordance with manufacturer's instructions and recommendations and the approved shop drawings.

E. The Contractor shall apply a polyurethane sealant, resilient gasket or non-shrink grout between the frame and wall surfaces as needed to produce a watertight seal. The sealant type shall be as recommended by the fabricated gate manufacturer and shall be suitable for submerged applications.

F. The Contractor shall have weir invert elevations set by a professional licensed surveyor at weir invert setpoint elevations shown on the Drawings at startup. Contractor shall mark stem covers with the invert setpoint elevations.

3.02 PAINTING AND SURFACE PREPARATION

A. The Contractor shall paint all of the cast iron and carbon steel fabricated gate components specified in this Section in accordance with Section 09900, Painting and Coating.

B. The gate manufacturer shall passivate all welds on stainless steel in accordance with ASTM A380/A380M.

3.03 FIELD TESTING

A. The Contractor shall provide the services of a factory authorized service representative to perform, approve, and certify the pre-startup testing and startup testing specified herein. The service representative shall be certified and employed by the manufacturer of the equipment specified herein. All field testing shall be provided in accordance with Section 11000, General Equipment Requirements.

1. The factory authorized service representative shall be onsite to perform the testing services specified herein in accordance with Table 11000-1 of Section 11000, General Equipment Requirements.

2. Pre-Startup Testing: The factory authorized service representative shall inspect each fabricated gate and verify that the components have been furnished and installed in accordance with the Contract Documents and manufacturer's recommendations.

3. Startup Testing: The factory authorized service representative shall be onsite a to perform the startup testing specified below in accordance with Table 11000-1 of Section 11000, General Equipment Requirements:

    a. With each basin or flow channel completely dewatered, the gate plate for each fabricated gate shall be fully raised and lowered along its guide system a minimum of three times to ensure that it operates freely and that the required clearance between the plate and gate guide groove are maintained at all times. During the startup testing, the geared hoists shall be adjusted as needed so that the maximum pull needed to raise and lower the plate does not exceed the value specified in this Section.

4. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing for this equipment in accordance with Section 11000, General Equipment Requirements.

   a. With each basin or flow channel is submerged, each fabricated gate shall be operated so that is fully closed (slide gates). When the downstream flow channel or basin has been isolated and dewatered below the gate plate invert, the Contractor shall measure the average leakage rate from each fabricated gate over a period of 30 minutes. If the leakage rate exceeds the design requirements specified herein, the Contractor shall adjust the gate components in the field as needed. If the leakage rate still exceeds the design requirements specified in this Section after the field adjustments have been performed, the Contractor shall furnish a factory authorized service representative onsite to inspect, repair, and adjust the fabricated gates as needed. These service representative services shall be furnished to the Owner at no additional cost.

3.04 TRAINING SERVICES

A. The factory authorized service representative shall be onsite to perform training services during the field testing services specified herein. Training services shall be in accordance with Section 11000, General Equipment Requirements.

3.05 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified herein in accordance with Section 11000, General Equipment Requirements.

END OF SECTION

SECTION 11310
OPEN SCREW PUMP EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install, place in operation, and field-test open screw pumps, motors, and control systems as specified in these Specifications.

B. These Specifications are intended to give a general description of what is required but do not cover all details, which will vary with the requirements of the equipment application. The Specifications are, however, intended to cover the furnishing, shop testing, delivery, complete installation, and field-testing of all materials, equipment, and appurtenances for the complete pumping systems as specified in this Section, whether specifically mentioned in these Specifications or not.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit to the Engineer copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations. The Contractor shall field-verify all elevations, angles, dimensions, clearances, etc. required by the manufacturer and as necessary to complete the work. These measurements shall be included on the certified shop and erection drawings.
2. Descriptive literature, bulletins, and/or catalogs of the equipment.
3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves that show that they meet the specified requirements for capacity based on screw diameter, number of flights, angle of inclination, fill depth, efficiency, and horsepower. Curves shall be submitted electronically. Curves shall be plotted from no flow to the maximum pump capacity. Catalog sheets showing a family of curves shall not be acceptable.

4. Complete master wiring diagrams, elementary or control schematics including coordination with other electrical control devices such as the pump control system, and suitable outline drawings shall be furnished for approval before proceeding with manufacture. Provide suitable outline drawings showing such details as are necessary to facilitate interconnections with other equipment. Standard pre-printed sheets or drawings simply marked to indicate applicability to this Contract shall not be acceptable. Refer to the Electrical Drawings for the control wiring diagrams for the pump motors.
5. A complete total bill of materials of all equipment.
6. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in Article 1.09, with the manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List bearings by the bearing manufacturer's numbers only.
7. Complete motor and drive data.

C. Test Reports to be Submitted:

1. Description of test procedures and equipment.
2. Copies of all test results, as specified in Parts 2 and 3 of this Section.

D. Complete operating and maintenance instructions shall be furnished for all equipment specified in this Section in accordance with the General Conditions and Division 1, General Requirements.

E. The Contractor shall submit the manufacturer's Certificate of Installation, Testing, and Instruction as specified in Division 1, General Requirements.

F. If it is impossible to conform to certain details of the Specifications due to different manufacturing techniques, describe completely all non-conforming aspects.

1.03 REFERENCE STANDARDS

A. American Bearing Manufacturers Association (AFBMA)

B. American Gear Manufacturers Association (AGMA)

C. American Institute of Steel Construction (AISC)

1. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings

D. American Society of Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Structural Steel.
2. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes
3. ASTM F3125/F3125M—Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

E. American Society of Civil Engineers (ASCE)

F. American Welding Society (AWS)

1. AWS D1.1/D1.1M—Structural Welding Code – Steel.
2. AWS QC1—Specification for AWS Certification of Welding Inspectors.

G. International Electrotechnical Commission (IEC)

H. Institute of Electrical and Electronics Engineers (IEEE)

I. National Electrical Manufacturers Association (NEMA)

J. Steel Structures Painting Council (SSPC)

1.04 QUALITY ASSURANCE

A. Qualifications

1. To ensure unity of responsibility, the pumps, motors, and drives shall be furnished and coordinated by the pump manufacturer. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire pumping systems including pumps, motors, drives, and controls as specified.
2. The equipment covered by these Specifications shall be standard units of proven ability as manufactured by a competent organization having long experience in the production of such equipment. The pumps furnished shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
3. All equipment furnished under this Specification shall be new and unused and shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified in this Section for a minimum of 5 years.

4. The manufacturer shall be fully responsible for the design, arrangement, and operation of all connected rotating components of the assembled pumping unit to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.

B. Services of Manufacturer's Representative

1. The equipment manufacturer shall furnish the services of a competent and experienced factory representative who has complete knowledge of proper installation, operation, and maintenance of the equipment in accordance with Table 11000-1 of Section 11000, General Equipment Requirements, to inspect the installed equipment, perform an initial test run, conduct final performance testing, and provide operating and maintenance instructions to the plant personnel.

   a. The first visit shall be for checking and inspecting the equipment after it is installed.
   b. The second visit shall be to perform the initial test run, conduct final performance testing, and provide operator training.

2. At least one of the days shall be allocated solely to the instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled with the Owner at least 10 days in advance and shall take place before pump station start-up and acceptance by the Owner. The final approved copies of operation and maintenance manuals must have been delivered to the Engineer before the instruction period is scheduled with the Owner.

3. The Contractor shall record, in a digital format, all training provided by the manufacturer's representative. The recording(s) or other electronic media shall become the property of the Owner.

4. If there are difficulties in operating the equipment due to the manufacturer's fabrication or the Contractor’s installation, additional service shall be provided at no change in Contract Price or Time.

1.05 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

B. All equipment supplied under this Section shall be warranted for 1 year by the Contractor and the manufacturer. The Warranty period shall begin as outlined in the General Conditions and Division 1, General Requirements.

C. The equipment shall be warranted to be free from defects in workmanship, design, and materials. If any part of the equipment fails during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner.

D. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

E. Refer to the General Conditions and Division 1, General Requirements, for additional warranty requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in the Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. All equipment and parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

C. Factory-assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. Finished surfaces of all exposed surfaces shall be protected by wooden blanks, strongly built and securely bolted.

E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

F. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.07 QUALIFICATIONS

A. All the equipment specified under this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and shall operate satisfactorily when installed.

B. All equipment furnished under this Section shall be new and unused and shall be the standard products of manufacturers having a successful record of

manufacturing and servicing the equipment and systems specified in this Section for a minimum of 5 years.

C. Any additional equipment necessary for the proper operation of the proposed installation not specifically mentioned in these Specifications or shown on the Drawings shall be furnished and installed at no change in Contract price or Time.

1.08 TESTING REQUIREMENTS

A. Testing shall be performed as specified in Part 2 and Part 3 of these Specifications.

1.09 MAINTENANCE

A. Spare Parts

1. The Contractor shall furnish the following spare parts in accordance with the requirements of Section 01600, Material and Equipment:

    a. One set of lower bearing seals.
    b. One grease pump pumping element kit.
    c. Manufacturer recommended spare parts for three units.

2. Spare parts shall be individually boxed with the project name and part number clearly identified on each individual box. All spare parts shall be shipped in a separate crate and clearly labeled. Spare parts shall be stored indoors by the Contractor in a temperature-controlled environment.

B. Special Tools

1. The Contractor shall furnish one set of all special tools required for normal operation and maintenance of the equipment.
2. Tools shall be furnished in a suitable steel case, clearly and indelibly marked on the exterior to indicate the equipment for which the tools are intended.

1.10 SYSTEM DESCRIPTION

A. All of the equipment included in this Section is intended to be standard for open screw pump applications.

B. The open screw pumps shall be as described in Table 11310-1 of these Specifications.

Table 11310-1 Screw Pump Design Requirements	
Number of Units	3
Pump Capacity	14,931-gpm
Hydraulic Lift (1)	11.80-feet
Angle of Inclination (1)	38-degrees
Pump Diameter	80-inch
Number of Flights	3
Flight Thickness	0.3125-inch
Torque Tube Diameter	36-inch
Torque Tube Wall Thickness	0.375-inch
Minimum Lower Bearing Diameter	6-inch
Minimum Upper Bearing Diameter	9-inch
Maximum Rotational Speed	34-rpm
Minimum Speed Reducer Torque Rating	165,247-in-lbs
Motor Size	75-hp
Electrical Power Characteristics	460V/60Hz/3ph
Motor and Solenoid Valve Electrical Classification	Non-Hazardous

Note: (1) The Contractor shall field-verify the dimensions as directed by the pump manufacturer and include the dimensions in the shop drawings.

C. Pumps shall be capable of successful operation without motor overload and without excessive vibration.

1.11 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. The manufacturer shall provide O&M manuals for the specific equipment with appropriate model numbers, pump curves, and motor data specific for this project. O&M manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The pumping units required under this Section shall be complete including pumps and motors with proper alignment and balancing of the individual units. All parts shall be designed and proportioned to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs, and adjustment shall be provided.

B. Pumps and drives shall be rigidly and accurately anchored into position. All necessary bolts, nuts, and washers shall be furnished by the Contractor. Anchor bolts, nuts, and washers shall be ASTM A276/A276M Type 302 stainless steel.

C. Each equipment item shall be furnished with a stainless steel nameplate (with embossed data) securely mounted to the body of the equipment. At a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, speed, and all other pertinent data. At a minimum, nameplates for motors shall include the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles, and power and service factors. Nameplate information for the adjustable-speed drives shall include the manufacturer's name and serial number, input speed, voltage, current and frequency, and horsepower at full load.

D. All working parts of the pumps, motors, and drives, such as bearings, wearing rings, shaft, sleeves, etc., shall be standard dimensions built to limit gauges or formed to templates so that parts will be interchangeable between like units and so that the Owner may, at any time in the future, obtain replacement and repair parts for those furnished in the original machines. All parts shall be properly stamped for identification and location in the machines as shown on the assembly drawings in the Operation and Maintenance Manuals furnished.

E. The nameplate ratings of the motors shall not be exceeded nor shall the design service factor be reduced when the pump is operating at any point on its characteristic curve.

F. Mechanical equipment, including drives and electric motors, shall be supplied and installed in accordance with applicable OSHA regulations.

2.02 PUMPS

A. General

1. The pumps shall be of the open screw type designed to pump raw wastewater.

2. The pumps shall be as manufactured by:

    a. The Lakeside Equipment Corporation of Bartlett, Illinois.
    b. Engineer-approved equal.

B. Performance Requirements

1. When operating at the maximum output speed of the motor, each pump shall have a characteristic performance curve that meets all the minimum conditions listed in Table 11310-1. The pumps and drive motors shall be capable of operating satisfactorily under the full range of conditions as

defined by Table 11310-1. The primary pump capacity, head, and efficiency defined in Table 11310-1 shall be the "design point."

2. With the pumping units operating at full motor speed, the maximum brake horsepower required by the pumps shall not exceed the maximum horsepower listed in Table 11310-1. If the pumping units require more than the maximum horsepower listed in Table 11310-1 at the motor output shaft at any full motor speed operation point, they will be rejected.

2.03 SPIRAL SCREW

A. Spiral screw shall be fabricated of ASTM A36/A36M steel. Each spiral screw shall have an outside diameter as noted in Table 11310-1 with the number of flights as noted in Table 11310-1. Flights shall be die formed with a 1:1 pitch-to-diameter ratio and shall have a minimum thickness as noted in Table 11310-1. Flights shall be helical shaped and continuously welded on both sides to the torque tube. There shall be no more than two flight butt welds per pitch, and all flight butt welds shall be full penetration joints. The screw shall be designed to rotate counter-clockwise when viewed from the lower bearing end up toward the drive assembly.

B. Each torque tube shall have a minimum diameter as noted in Table 11310-1 with a minimum wall thickness as noted in Table 11310-1 so that screw deflection shall not be greater than the bearing center distance divided by 2,000. Calculations for deflection and bearing loads shall be based on the dead weight of the screw plus the full weight of liquid being pumped. Decreased loading from buoyance effects shall not be considered in the design calculations.

C. The torque tube shall be sealed watertight with a welded steel plate at each end. All surfaces of the end plates mating with the bolted stub shafts shall be finish-machined while the pump is supported between centers in a lathe after welding to the support tube and after all flight welding is complete to ensure alignment and parallelism.

D. A solid steel upper drive shaft and lower stub shaft fitted with machine faced steel plate flange shall be fastened to the upper and lower ends of the fabricated spiral screw with ASTM F3125/F3125M high-strength bolts.

E. The screw shall be placed in a lathe, and the flights shall be ground to a true radius after fabrication.

2.04 LOWER BEARING ASSEMBLY

A. The lower bearing assembly shall be a cam-type with a pressure-grease-lubricated bronze sleeve bearing pressed onto the shaft and shall carry the radial load of the

screw. Lower bearing nominal diameter shall be as noted in Table 11310-1. No thrust load shall be carried by the lower bearing.

B. The bronze sleeve shall rotate with the lower stub shaft in a bearing housing containing a minimum of two spring-loaded lip seals at the top of the bearing assembly. The seals shall be arranged so that one seal excludes wastewater and contaminants from the bearing and the other holds the grease in the bearing. The use of less than two lip seals shall not be acceptable.

C. The bearing assembly shall permit precise angular (vertical) and lateral (horizontal) field adjustment to eliminate misalignment between the upper and lower bearings without the use of shims. Bearing assembly shall accommodate all static and operating deflections of the screw. Bearings with fixed or rigid shafts and housings shall not be acceptable.

D. The bearing assembly shall be supplied with a split non-rotating shield installed between the housing and rotating screw for operation of the shaft and seals.

E. The bearing assembly shall accommodate thermal expansion and contraction of the screw within the bearing housing on fully lubricated surfaces not subject to corrosion or seizure.

F. The bottom of the bearing housing shall be fitted with an inspection plate that can be removed for inspection of the lower bearing without disassembly of the lower stub shaft or bearing housing.

G. The use of roller or ball bearings shall not be acceptable.

H. There shall be a flow through grease system with grease entering the lower part of the housing and passing across the full face of the bearing sleeve to the upper seals, then to a grease collection container for confirmation the bottom bearing is receiving grease from the automatic lubrication system.

2.05 UPPER BEARING ASSEMBLY

A. The upper stub shaft shall be a one-piece fabricated steel or forged steel design. Two-piece stub shaft designs (shaft and mating flange) shall not be acceptable for this project.

B. The upper stub shaft shall extend through a grease-lubricated upper bearing assembly that shall consists of a split housing fitted with dual bearings, lower spring loaded lip seal, bearing spacer, and upper spring loaded lip seal. Upper bearing nominal diameter shall be as noted in Table 11310-1.

C. All of the thrust load from the pump shall be carried by a spherical thrust-type bearing assembly, and the upper screw pump radial load shall be carried by a spherical roller bearing. A single dual-purpose bearing shall not be acceptable.

D. The two bearings (radial and thrust) shall be positioned in the bearing housing so that the pressure center of the thrust bearing and radial bearing intersects the axis of the screw at the same point to provide true self-alignment in all planes.

E. Both radial and thrust bearings shall be rated at a minimum of 100,000 hours AFBMA L10 theoretical design life, based on the dead weight of the screw plus the full weight of the liquid being pumped.

F. Upper stub shaft shall be grooved and positively locked into the upper bearing assembly by a split collar and locking halter ring. Use of threaded nuts to lock bearings and shafts for support of thrust loading shall not be acceptable.

G. A split-bearing housing shall be provided to allow removal of the cover for inspection of the bearings without removing the stub shaft or the entire bearing assembly.

2.06 DRIVE ASSEMBLY

A. The drive assembly shall be designed and constructed for a maximum screw rotational speed as noted in Table 11310-1. The drive assembly shall consist of a parallel-shaft speed reducer, belts, sheaves, motor, and coupling.

B. The speed reducer shall be a parallel-shaft, triple reduction, foot-mounted unit suitable for outdoor operation. Speed reducer sizing shall be based on the latest AGMA standards using a minimum 1.5 service factor based on the maximum torque requirements of the screw or a minimum 1.25 service factor based on motor horsepower, whichever is greater. The minimum speed reducer torque rating shall be as noted in Table 11310-1.

C. The speed reducer housing shall be manufactured from high-quality cast iron accurately machined for perfect alignment of all shafts and gearing. The speed reducer housing shall be furnished complete with an air breather, drain plug, dipstick or oil level indicator, and an inspection cover. All casting joints shall be precision ground to ensure an oil-tight and dust-proof housing.

D. The gearing shall be high-quality alloy steel, hobbed, and ground for maximum accuracy. All shafts shall be supported by roller-type anti-friction bearings.

E. The gearing and bearings shall be automatically splash or force-feed lubricated. Force-feed lubrication systems shall include a shaft-driven oil pump, and all

necessary piping integral shall be mounted on the gear reducer. Oil cooling shall be accomplished by convection and shall not require an external cooling source.

F. The low-speed and high-speed shafts shall be provided with spring-loaded lip seals suitable for inclined mounting.

2.07 BELTS AND SHEAVES

A. Power transmission from the motor to the reducer shall be by means of a set of V-belts and sheaves. Belts and sheaves shall be designed with a 1.5 service factor based on full motor horsepower.

B. Sheaves shall be two section units for both drive and driven sheaves and shall consist of a tapered split shaft bushing with three tapped holes to which the sheave is attached by three cap screws. Changing sheaves shall not require a wheel puller.

C. Belts and sheaves shall be covered with a fabricated aluminum belt guard in accordance with OSHA standards.

2.08 MOTOR

A. Motors shall be designed to accept all loads imposed by the pump during starting and running.

B. Motors shall be built in accordance with the latest NEMA, IEEE, ANSI, and AFBMA standards where applicable.

C. Each unit shall be driven by an 1,800 rev/min, 1.15 service factor, horizontal, ball bearing, continuous duty, constant speed, Design B, normal starting torque, totally enclosed fan-cooled, premium-efficiency, foot-mounted motor with leads to gasketed conduit box for outdoor operation.

D. Motor size, electrical power characteristics, and electrical environment shall be as noted in Table 11310-1.

E. Motor shall be mounted on a fabricated steel plate, which provides adjustment of belt slack.

2.09 FLEXIBLE LOW-SPEED COUPLING

A. The upper stub shaft of the screw pump shall be connected to the drive assembly by a flexible coupling.

B. Coupling shall be designed for a 1.5 service factor, based on brake horsepower, and shall be keyed and bored to suit the reducer slow speed shaft and the screw pump upper stub shaft.

C. The flexible coupling shall be covered with a removable aluminum guard in accordance with OSHA standards.

2.10 SUPPORT AND ANCHORAGE OF UPPER BEARING AND DRIVE ASSEMBLIES

A. For each screw pump installation, the Contractor is responsible for coordinating with the pump manufacturer and verifying that the existing concrete support is of sufficient size and strength for supporting the upper bearing and drive assemblies.

B. The existing concrete supports shall be prepared as shown on the Drawings.

C. The upper bearing and drive assemblies shall be rigidly and accurately anchored into position into to the existing concrete support with epoxy embedded anchor bolts. All anchor bolts, nuts, and washers shall be Type 304 stainless steel and shall be furnished by the pump manufacturer. The size, length, and depth of embedment of the anchors shall be per the manufacturer's recommendations. Expansion-type anchors shall not be acceptable.

D. Anchor bolts shall be set by the Contractor. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

2.11 DEFLECTION PLATES

A. A flow deflection plate shall be provided to curve around the upper section on the uptake side of the screw to deflect the liquid as the screw rotates.

B. The flow deflection plate shall be fabricated of not less than 3/16-inch thick AISI Type 304 stainless steel plate complete with stiffeners where required and stainless steel anchors on 2-foot centers at the bottom edge.

C. The deflection plate top edge shall have adjustable stainless steel anchors at no more than 8-foot centers.

2.12 AUTOMATIC LUBRICATION SYSTEM

A. Each screw pump shall be furnished with a positive pressure, automatic lubrication pump and 3/8-inch minimum diameter stainless steel grease line.

B. The automatic lubrication pump shall provide grease lubricant to the lower bearing assembly with provisions at the pump to manually charge the grease line.

C. Each screw pump shall be furnished with a positive pressure, automatic lubrication pump with stainless steel grease reservoir, and 3/8-inch minimum diameter stainless steel grease line.

D. Each lubrication pump shall be adjustable and shall provide 6 ounces per day at the minimum setting and 17 ounces per day at the maximum setting (nominal). Grease reservoir shall hold a minimum of 15 pounds of lubricant.

E. The lubricant pump shall consist of an eccentric piston pumping element and a check valve and shall have a 1/3-horsepower, TEFC, ball bearing, gear motor connected to the lubricator by a flexible coupling. Grease pump motor shall be rated for electrical power characteristics and for an electrical environment as noted in Table 11310-1.

F. A centrifugal switch shall be furnished as an integral component of the grease pump and interlocked with the screw pump drive system. When the screw pump is required to operate, the lubrication pump motor shall switch on. As the lubrication pump motor reaches full speed, the centrifugal switch shall close, energizing the screw pump drive motor. If the grease pump motor stops, the centrifugal switch shall open, de-energizing the screw pump drive motor. The centrifugal switch shall be rated for no less than 3 amps at 120 VAC, resistive.

G. The lubrication system shall be factory-assembled on a steel-base plate or coordinated for connection to the existing structures as determined in the field. The coupling shall have a removable metal coupling guard in accordance with OSHA standards.

H. To protect the environment from contamination and to provide visual indication that the lower bearing is receiving a steady supply of lubricant, spent grease that has passed through the lower bearing shall be recovered in a stainless steel collection container with two 1/4-inch holes located 1 inch from the top of the container to allow liquid to drain out of the container.

2.13 GROUTING MATERIALS

A. Equipment manufacturer shall furnish a radius screed for the Contractor to place the finishing grout in the trough with the screw after the unit has been installed.

B. Equipment manufacturer shall loan to the Contractor additional sheave(s) and belts as required to operate the screw at a reduced speed for grouting the trough with the screw pump drive.

C. The finish grout for the trough shall be as specified as indicated on the Structural Drawings.

2.14 CONTROLS

A. Pump instrumentation and controls shall be integrated to existing.

2.15 SHOP SURFACE PREPARATION AND PAINTING

A. Before exposure to weather and before shop painting, all surfaces shall be thoroughly cleaned, dry, and free from all mill-scale, rust, grease, dirt, and other foreign matter.

B. All exposed portions of the pumps and motors shall be shop-primed in accordance with Section 09900, Painting and Coating. Primer shall be compatible with the finish paint specified in Section 09900, Painting and Coating.

C. Electric motors, speed reducers, and other self-contained or enclosed components shall be supplied with the manufacturer's standard finish coating.

D. Rust preventative compound shall be applied to all machined, polished, and nonferrous surfaces, which are not to be painted.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required grease for initial operation. The grades of grease shall be in accordance with the manufacturer's recommendations. Anchor bolts shall be set in accordance with the manufacturer's recommendations.

B. The Contractor shall submit a certificate stating that the installation is in accordance with the manufacturer’s instructions and NMAP Millwright standards.

C. The Contractor shall submit a certificate from the manufacturer stating that the installation of the equipment is satisfactory; that the equipment is ready for operation; and that the operating personnel have been suitably instructed in the operation, lubrication, and care of each unit.

3.02 FIELD PAINTING

A. The Contractor shall field touch-up the shop-applied primer coat in areas where the paint was damaged during shipping as soon as the equipment arrives on site. The coating shall be as specified in Section 09900, Painting and Coating.

B. The Contractor shall apply the intermediate and finish coats as specified in Section 09900, Painting and Coating.

C. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to ensure compatibility.

D. All nameplates shall be properly protected during painting.

E. Before assembly, the Contractor shall coat all stainless steel bolts and nut threads with a non-seizing compound.

3.03 FIELD TESTING

A. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

B. Field Pump Tests

1. After installation, the Contractor shall demonstrate to the Owner and Engineer that the installed equipment can perform satisfactorily under actual field conditions. The pumps shall be field-tested to verify mechanical integrity and soundness of construction, installation, and operation.
2. After the equipment has been operated long enough to make all desirable corrections and adjustments, each pumping unit and all associated equipment shall be field-tested to determine that operation is satisfactory, free from excessive vibration and noise, and in compliance with these Specifications.
3. If the pump performance, including vibration levels or natural frequency, does not meet the Specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps that satisfy the conditions specified, and the pumps shall be retested. A 24-hour operating period of the pumps shall be required before acceptance.
4. All pump operating settings, alarms, controls, and shutdown devices shall be calibrated and tested during the field tests.
5. The Contractor shall furnish all power, water, facilities, labor, materials, supplies, and test instruments required to conduct field test.

6. Upon completion of satisfactory testing of the equipment, the Contractor shall deliver to the Engineer reports as specified in Division 1, General Requirements.

C. Field Electric Control System Tests

1. The Contractor shall test-operate each drive and electric control system for proper functioning before the pump mechanical test. The control system shall be checked out using simulated operating signals in accordance with the drive manufacturer's recommendations.
2. Check all drives for correct clearances, alignment, and lubrication before start-up in accordance with the respective manufacturer's instructions.

D. Field Motor Tests

1. Megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, notify the Engineer. Do not energize the motor.
2. Check all motors for correct clearances and alignment and for correct lubrication in accordance with the manufacturer's instructions. Check direction of rotation of all motors and reverse connections if necessary.
3. Perform all testing requirements as specified in Division 16, Electrical.

E. Field Alarm System Testing

1. Check each alarm and detection device for proper operation.

3.04 SOURCE QUALITY CONTROL

A. All structural steel components shall be fabricated in the United States and shall conform to the requirements of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" published by the AISC. Except where specifically indicated otherwise, all plates and structural members shall have a minimum thickness of 1/4 inch.

B. The equipment manufacturer's shop welds and welding procedures shall be in accordance with the requirements of the latest edition of ANSI/AWS D1.1 "Structural Welding Code - Steel" published by the AWS.

C. Design and fabrication of structural steel members shall be in accordance with AISC and AWS Standards. The manufacturer shall comply with the AWS and AISC most current listed standards and qualifications in AWS D1.1/D1.1M, the criteria in accordance with the requirements of Section 6 – Inspection – Structural

Welding Code. Evidence of such AWS and AISC compliance shall be submitted with shop drawing submittals as follows:

1. AWS Certified Welding Inspectors (minimum 2 on staff) shall conform to all standards, current or previous as listed in Section 6.1.4 AWS QC1, Specification for AWS Certification of Welding Inspectors.
2. AWS Non Destructive Testing Inspectors (Level I, II, III) for Magnetic Particle and Ultra-Sonic testing (minimum 2 on staff) shall conform to all standards, current or previous as listed in and in conformance with The American Society of Non-Destructive Testing (ASNT-TC-1A).

3.05 INSTALLATION

A. The manufacturer shall schedule three trips to the project site for equipment start-up assistance as noted in Paragraph 3.03.B. for the Contractor and for operating training as noted in Paragraph 3.06.A. for Owner personnel.

B. After the Contractor has installed the screen and the equipment is capable of being operated, the equipment manufacturer shall furnish a qualified representative in accordance with Table 11000-1 of Section 11000, General Equipment Requirements, to perform start-up inspection and training of the equipment for the Contractor.

3.06 OPERATOR TRAINING

A. The Contractor shall provide operator training for Owner's personnel after system is operational. Training will take place while manufacturer's representative is at the job site for inspection.

END SECTION

DIVISION 15

MECHANICAL

SECTION 15075
PROCESS EQUIPMENT, PIPING, AND VALVE IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes requirements for materials and installation of markers, labels, and signs for pipes, tanks, and valves; for mechanical equipment; for hazardous materials warnings; and for miscellaneous plant services.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit manufacturer's catalog data and descriptive literature describing materials, colors, letter size, and size of labels.

1.03 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 LABELS FOR MECHANICAL EQUIPMENT

A. The Contractor shall provide a label for each screw pump or other piece of mechanical equipment. The label shall show the equipment name and tag number as shown on the Tag Number list or on the Drawings. Labels shall be 1-1/2 inches (minimum) by 4 inches (minimum) brass, aluminum, or 1/8-inch-thick fiberglass tags.

2.02 UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

A. The Contractor shall provide permanent, bright-colored, continuous-printed plastic tape intended for direct burial service, not less than 6 inches wide by 3.5 mils thick. Provide tape with printing that most accurately indicates the type of service of buried pipe. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Gas	Yellow
Electric	Red
Telephone	Orange
Water	Blue
Sewer	Green
Chemical	Yellow
Reclaimed Water	Violet

2.03 UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

A. The Contractor shall provide permanent, bright-colored, continuous-printed tape consisting of an aluminum or steel foil sheathed in a plastic laminate, not less than 2 inches wide by 3 mils thick. Provide tape with printing that most accurately indicates the type of buried service. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Gas	Yellow
Electric	Red
Telephone	Orange
Water	Blue
Sewer	Green
Chemical	Yellow
Reclaimed Water	Violet

PART 3 EXECUTION

3.01 INSTALLING PIPE LABELS

A. The Contractor shall provide a label and flow arrow at each connection to pumps or other mechanical equipment, at wall boundaries, at tees and crosses, and at 20-foot centers on straight runs of piping.

B. On piping having external diameters less than 6 inches (including insulation, if any), the Contractor shall provide full-band pipe markers, extending 360º around pipe at each location.

C. On piping having external diameters of 6 inches and larger (including insulation, if any), provide either full-band or strip-type pipe markers but not narrower than

three times letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe or insulation.
2. Strapped-to-pipe or insulation application of semirigid type with Type 304 or 305 stainless steel bands.

3.02 INSTALLING MISCELLANEOUS SIGNS

A. The Contractor shall attach miscellaneous signs according to the sign manufacturer's recommendations and in accordance with OSHA requirements.

3.03 INSTALLING UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

A. During backfilling of each exterior underground piping system, the Contractor shall install continuous underground-type plastic line marker directly over buried line at 6 to 8 inches above the top of the pipe. Where multiple small lines are buried in common trench and do not exceed overall width of 16 inches, install a single line marker.

3.04 INSTALLING UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

A. The Contractor shall install tape 4 to 6 inches below finished ground surface directly over buried pipelines. Where multiple small pipelines are buried in a common trench and do not exceed an overall width of 16 inches, install a single marker tape.

END OF SECTION

DIVISION 16

ELECTRICAL

SECTION 16050
ELECTRICAL – GENERAL PROVISIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish all labor, materials, equipment and incidentals required for a complete electrical system as hereinafter specified and shown on the Drawings, whether or not specifically shown or called for.
2. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Drawings shall include all items listed hereinafter an/or shown on the Drawings. All materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete power, wiring and demolition as indicated on the Drawings and/or as specified herein whether or not specifically shown or called for. Certain equipment will be furnished as specified in other sections of these Specifications, which will require conduit and wire to complete the installation as required.
3. The Contractor shall furnish and install the necessary cables, transformers, motor control centers, protective devices (surge protection), conductors, exterior electrical system, etc., to serve motor loads, lighting loads and miscellaneous electrical loads as indicated on the Drawings and/or as specified hereinafter.
4. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.
5. Make all field connections to process instrument panels and other control panels furnished under other Divisions of these Specifications.
6. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material, equipment, appliances and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.
7. Each bidder or his authorized representatives shall, before preparing a bid, visit all areas of the existing building and/or proposed site in which work will take place and be performed to carefully inspect the present installation and conditions. The submission of the bid by this bidder shall be considered evidence that the bidder has visited the project and noted the locations and conditions under which the work will be performed and that

the bidder takes full responsibility for a complete knowledge of all factors governing his work.

8. All necessary temporary power requirements are the responsibility of the Contractor and shall be furnished at no extra cost to the Owner.
9. All necessary temporary power, control and instrumentation requirements are the responsibility of the Contractor and shall be furnished at no extra cost to the Owner. Power and controls shall be furnished to all existing equipment at all times.

B. Service and Metering

1. Permanent electrical power and metering will be provided by the at 227/480 volts, three-phase, four-wire, wye, solid grounded, 60-Hertz.

C. Codes, Inspections, and Fees

1. All material and installation shall be in accordance with the latest edition of the National Electrical Code and all applicable national, local and state codes.
2. Pay all fees required for permits, inspections, and connections.

D. Tests

1. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

E. Interpretation of Drawings

1. The Drawings are not intended to show exact location, quantity or size of conduit runs. All installation of the raceway system shall be as directed by approved shop drawing. Any installation of a raceway system before shop drawing submittal and approval will at the sole risk of the Contractor.
2. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.
3. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.
4. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.
5. The Contractor shall harmonize the work of the different trades so that interferences between conduits, piping, equipment, architectural and structural work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc., required

to accomplish this shall be furnished and installed by the Contractor without additional expense to the Owner. In case interference develops, the Owner's authorized representative is to decide which equipment, piping, etc., must be relocated, regardless of which was installed first.

6. Verify with the Engineer exact locations and mounting heights of lighting fixtures, switches and receptacles before installation.
7. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and, in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
8. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
9. Circuit layouts shown are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.
10. The ratings of motors and other electrically operated devices together with the size shown for their branch circuit conductors and conduits are approximate only and are indicative of the probable power requirements insofar as they can be determined in advance of the purchases of the equipment.
11. All connections to equipment shall be made as shown, specified, required, and directed and in accordance with the approved shop drawings, regardless of the number of conductors shown on the Electrical Drawings.

F. Size of Equipment

1. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.
2. The equipment shall be kept upright at all times. When equipment has to be tilted for each of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

G. Component Interconnections

1. Component equipment furnished under this Specification will not be furnished as integrated systems.
2. Analyze all systems components and their shop drawings; identify all terminals and prepare drawings or wiring tables necessary for component interconnection.

H. Record Drawings

1. As the work progresses, legibly record all field changes on a set of project Contract Drawings.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Material and Shop Drawings

1. As specified under Section 01330, Submittals and Acceptance, shop drawings shall be submitted for approval of all materials, equipment, apparatus, and other items as required by the Engineer.

2. Shop drawings shall be submitted for the following equipment:

   a. Control Panels.
   b. Disconnect Switches.
   c. Wire and Cable.
   d. Supporting Devices.
   e. Test Data.

3. The manufacturers' name and product designation or catalog numbers shall be submitted for the following material:

   a. Conduit.
   b. Receptacles.
   c. Boxes and Fittings.
   d. Switches.

4. Before submittal by the Contractor, all shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This

statement shall also list all discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.

5. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Drawings. The responsibility of, or the necessity of, furnishing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings is included under the work of this Section.

6. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section.

7. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

B. Manufacturer’s Services

1. Provide manufacturer's services for testing and start-up of the following equipment:

   a. Recycle Control Panels.

2. Provide manufacturers of the above listed equipment shall provide an experienced Field Service Engineer to accomplish the following tasks:

   a. The equipment shall be visually inspected upon completion of installation and before energizing to assure that wiring is correct, interconnection complete and the installation is in compliance with the manufacturer's criteria. Documentation shall be reviewed to assure that all Drawings, operation and maintenance manuals, parts list and other data required to check out and sustain equipment operation is available on site. Documentation shall be red-lined to reflect any changes or modifications made during the installation so that the "as-built" equipment configuration will be correctly defined. Spare parts shall be inventoried to assure correct type and quantity.
   b. The Field Service Engineers shall provide engineering support during the energizing and check out of each major equipment assembly. They shall perform any calibration or adjustment required for the equipment to meet the manufacturer's performance specifications.

c. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with manufacturer's test specifications.

d. Three 4-hour training sessions (one for each system) on operation, and two 4-hour training sessions (one for each system) on maintenance and trouble-shooting procedures shall be provided for the Owner's maintenance personnel. All training shall be conducted at a facility provided by the Owner. The maintenance and trouble-shooting sessions shall be conducted with record "as-built" electrical drawings sufficient for a class of eight personnel.

e. A final report shall be written and submitted to the Contractor within 14 days of completion of final system testing. The report shall document the inspection and test activity, define any open problems and recommend remedial action.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or manufacturer's specifications shall be submitted for approval as required by the Engineer.

B. Materials and equipment used shall be Underwriters Laboratories, Inc. listed.

C. Electrical equipment shall, at all times during construction, be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, at the cost and expense of the Contractor, or shall be replaced by the Contractor at his own expense.

D. Surface mounted raceways and boxes mounted on tanks. Tanks walkways shall be stainless steel as noted on drawings. All fasteners shall be Type 316 stainless steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide and place all sleeves for conduits penetrating floors, walls, partition, etc. Locate all necessary slots for electrical work and form before concrete is poured.

B. All cutting and patching shall be done in a thoroughly workmanlike manner.

3.02 INSPECTION AND TESTING

A. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

END OF SECTION

SECTION 16075
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install identification for raceways; power and control cables; conductors; underground-line warning tape, warning labels and signs; instruction signs; equipment identification labels; and any other miscellaneous identification products as shown in the Drawings and specified in this Section.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: For each electrical identification product indicated.

1.03 WORK SEQUENCE

A. The Contractor shall coordinate identification names, abbreviations, colors, and other features with requirements in other sections requiring identification applications; Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operations and Maintenance (O&M) Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout the Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with locations of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

1.04 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of

this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American National Standards Institute (ANSI)

1. ANSI Z535—Safety Alerting Standards.

B. American Society for Testing and Materials (ASTM)

1. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
2. ASTM D882—Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

C. American Society of Mechanical Engineers (ASME)

1. ASME A13.1—Scheme for the Identification of Piping Systems.

D. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2—National Electrical Safety Code.

E. Occupational Safety and Health Administration (OSHA)

1. 29 CFR 1910.144—Safety Color Code for Marking Physical Hazards.
2. 29 CFR 1910.145—Specifications for Accident Prevention Signs and Tags.

F. National Fire Protection Association (NFPA)

1. NFPA 70—National Electric Code.
2. NFPA 70E—Standard for Electrical Safety in the Workplace.

G. Underwriter's Laboratories (UL)

1. UL 969—Marking and Labeling Systems.

1.05 QUALITY ASSURANCE

A. Comply with ASME A13.1
B. Comply with NFPA 70.
C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
D. Comply with ANSI Z535.4 for safety signs and labels.

PART 2 PRODUCTS

2.01 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ASME A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER: CONCEALED HIGH-VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch-wide black stripes on 10-inch centers diagonally over orange background that extends the full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2-inch-by-2-inch-by-0.05-inch with stamped legend, punched for use with self-locking cable tie fastener.

I. Write-On Tags: Polyester tag,0.015-inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.02 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ASME A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.03 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches.

2.04 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.05 UNDERGROUND-LINE WARNING TAPE

A. Tape

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type I

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 28 pounds/1,000 square feet.
5. 3-Inch Tensile According to ASTM D882: 70 lbf and 4,600 psi.

2.06 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include but are not limited to the following legends:

1. Multiple Power Source Warning: "DANGER: ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING: OSHA REGULATION – AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
3. Arc Flash Warning Label: Refer to NFPA 70E for arc flash warning label requirements.

2.07 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 square inches and 1/8-inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.08 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8-inch.

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8-inch.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.09 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16-inch.
2. Tensile Strength at 73ºF, According to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40º to plus 185ºF.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one-piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16-inch.
2. Tensile Strength at 73ºF, According to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40º to plus 185ºF.
4. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Section 09900, Painting and Coating, for paint materials and application requirements. Select a paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Verify the identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Align nameplates in center near the top of equipment being marked.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Attach signs and plastic labels with mechanical fasteners appropriate to the location and substrate.

E. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by the manufacturer of the identification device.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot-maximum intervals in straight runs and at 25-foot-maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches, install continuous underground-line warning tape directly above line at 12 inches below finished grade. Use multiple tapes where the width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Comply with requirements in Division 9 Painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Identify all devices operating at more than 250 VAC phase-to-phase or 125 VAC phase-to-ground with red enamel letters or numerals of appropriate height applied with a stencil.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than30 A, and 120 V to ground: Identify with self-adhesive vinyl label self-adhesive vinyl tape applied in bands. Install labels at 30-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels

with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

D. Power wiring and control wiring shall be identified in all handholes with a waterproof permanent tag attached to the cable with plastic cable ties.

E. Conductors shall be identified at each termination, pull box, junction box, handhole, point of entry to or exit from wireways, panelboards, control panels, and other points of access. Tags or labels shall be securely affixed to the conductor in visible locations. Tags shall be durable plastic with the designation stamped on one side with suitable dies. Labels shall be permanent with legible black characters on white heat-shrink tubing or equivalent identification acceptable to the Owner.

1. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase. Tags or labels shall identify both the switchboard, MCC, panel, etc., it is served from and the circuit number.

2. Control conductor (including monitor and instrumentation conductors) shall be identified by color coding and tag or label as to wire number (corresponding to the manufacturer's wiring diagram) and equipment name.

3. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

    a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

    b. Colors for 208/120V Circuits:

        (1) Phase A: Black.
        (2) Phase B: Red.
        (3) Phase C: Blue.

c. Colors for 480/277V Circuits:

(1) Phase A: Brown.
(2) Phase B: Orange.
(3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Power-Circuit Conductor Identification, more than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

G. Install instructional sign, including the associated color-code, for grounded and ungrounded conductors using adhesive-film-type labels.

H. Conductors to Be Extended in the Future: Attach identification tags to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use a system of marker tape designations that is uniform and consistent with the system used by the manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the O&M Manual.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for direct-buried cables and for cables in the raceway.

K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment, including but not limited to the following:

a. Controls with external control power connections.

M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

N. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the O&M Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification. Identification plates shall be furnished for lighting and power panelboards, motor control centers, all line voltage heating and ventilating control panels, fire detector and sprinkler alarms, door bells, pilot lights, disconnect switches, manual starting switches, magnetic starters, and process control devices.

1. Identification plates shall be furnished for all line-voltage enclosed-circuit breakers; the plates shall identify the equipment served, voltage, phase(s), and power source. Circuits 480 volts and above shall have conspicuously located warning signs in accordance with OSHA requirements.

2. Provide nameplates of minimum letter height as scheduled below:

a. Panelboards, switchboards, and motor control centers: 1/4-inch, identify panel name; 1/8-inch, identify voltage, phase, number of

wires, and source. Panelboards and control panels shall have designation in 1/4-inch high letters and voltage in 1/8-inch high letters centered above door on exterior trim.

b. Safety switches: same as above.

c. Safety color coding for identification of warning signs shall conform to NEMA Z535.

d. Red identification plates reading CAUTION: 480/277 VOLTS shall be provided in switch and outlet boxes containing 277- or 480-volt circuits. An identification plate marked DANGER: 480 VOLTS shall be provided on the outside of 480-volt enclosures. The identification plate shall use white lettering on a red laminated plastic.

3. Any equipment with externally powered wiring shall be marked with a laminated plaster name plate having 3/16-inch-high white letters on a red background as follows: DANGER: EXTERNAL VOLTAGE SOURCE.

4. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic, Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

b. Outdoor Equipment: Engraved, laminated acrylic, or melamine label.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Mark equipment mounted remotely from the source of power (such as pumps and fans) with equipment number, source of power, and starter location. Where starters are remotely mounted, marking shall include equipment name, number, and location.

e. Unless labels are provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

5. Equipment to be Labeled :

a. Panelboards: Typewritten directory of circuits in the location provided by the panelboard manufacturer. Panelboard identification shall be engraved label.

b. Enclosures and electrical cabinets.

c. Access doors and panels for concealed electrical items.

d. Switchboards.

e. Transformers: Label that includes tag designation shown on the Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
f. Emergency system boxes and enclosures.
g. Enclosed switches.
h. Enclosed circuit breakers.
i. Enclosed controllers.
j. Variable-speed controllers.
k. Push-button stations.
l. Power transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.
o. Monitoring and control equipment.
p. UPS equipment.

END OF SECTION

SECTION 16110
RACEWAYS AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

B. The complete above grade raceway system shall be rigid aluminum and polyvinyl chloride (PVC)-40 below grade.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

B. Standards

1. Underwriters Laboratories, Inc. (UL)
2. American Society for Testing and Materials (ASTM)
3. Federal Specifications (FS)

C. Manufacturers

1. Non-Metallic Raceways:

a. Carlon.
b. Triangle Pipe and Tube Co.
c. Phillips Petroleum Co.
d. Indian Head Company.
e. Or equal.

2. Metallic Raceways:

a. Youngstown Sheet and Tube Co.
b. Allied Tube and Conduit Corp.
c. Wheeling-Pittsburg Steel Corp.
d. Or equal.

1.03 SUBMITTALS

A. Material and Shop Drawings

1. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:

a. Certified shop drawings with performance data and physical characteristics.
b. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
c. All information required by Section 01330, Submittals and Acceptance.
d. A complete total bill of materials for all equipment.

2. In the event that it is impossible to conform with certain details of the Specifications, describe completely all non-conforming aspects of the Shop Drawing transmittal.

PART 2 PRODUCTS

2.01 GENERAL

A. The Specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these Specifications, or shown on the Drawings shall be furnished and installed.

B. The material covered by these Specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS AND EQUIPMENT

A. Metallic Conduit

1. ALUM conduit shall contain less than 0.1% copper and conform to FS WW-C-540C.

B. Non-Metallic Conduit and Fittings

1. PVC conduit shall be Schedule 80 composed of High Impact PVC (C-200 Compound), and shall conform to industry standards, and be UL listed in accordance with Article 347 of National Electrical Code for underground and exposed use. Materials must have tensile strength of 55 pounds per square inch (psi), at 70 degrees F, flexural strength of 11,000 psi, compression strength of 8600 psi. Manufacturer shall have 5 years' extruding PVC experience.
2. Liquidtight Flexible Conduit and Fittings shall be for use per Article 351 of the NEC. PVC compounds shall not include fillers. Fittings shall be manufactured from high impact PVC.

C. Liquidtight, Flexible Non-Metallic Conduit, Couplings, and Fittings

1. Liquidtight, flexible non-metallic conduit shall be all PVC conduit and manufactured by Thomas and Betts Co., K-Flex, Inc., or equal.
2. Fittings used with Liquidtight flexible conduit shall be of the non-metallic type as manufactured by the Thomas and Betts Co., Xtraflex System, K-Flex, Inc., or equal.

D. Flexible Couplings

1. Flexible Couplings shall be as manufactured by the Thomas and Betts Co., K-Flex, Inc., or equal.

E. Conduit hubs shall be as manufactured by Myers Electric Products, Inc., Raco Div., Appleton Electric Co., or equal.

F. Conduit wall seals shall be Type WSK as manufactured by the O.Z. Electrical Mfg. O., or equal.

G. Combination expansion-deflection fittings shall be Type XD as manufactured by the Crouse-Hinds Co., or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendation, in the location shown on the Drawings.

B. No conduit smaller than 1/2-inch electrical trade size shall be used, nor any have more than three 90 degree bends in any one run. Pull boxes shall be provided as required or directed. Minimum size floor conduit shall be 3/4-inch.

C. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

D. The ends of all conduit shall be tightly plugged to exclude dust and moisture while the buildings are under construction.

E. Conduit supports shall be spaced at intervals of 4 feet or less, as required to obtain rigid construction. Conduit straps shall be type as manufactured by "CLIC".

F. Single conduits shall be supported by means of one-hole non-metallic pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with fiberglass horizontal members and fiberglass treaded hanger rods. The rods shall be not less than 3/8-inch-diameter.

G. Conduit hangers shall be attached to structural steel by means of non-metallic beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

H. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.

I. No broken run shall exceed 500 feet in length. This length shall be reduced by 75 feet for each 90-degree elbow.

J. Conduit terminating in boxes shall have sealing double lock-nuts and insulating bushings.

K. Conduit terminating in gasketed enclosures shall be terminated with sealing conduit hubs.

L. Conduit wall seals shall be used for all conduits penetrating walls below grade or other locations shown on the Drawings.

M. Liquidtight flexible metal conduit shall be used for all motor terminations and other outdoor equipment where vibration is present.

N. Flexible couplings shall be used in hazardous locations for all motor termination and other equipment where vibration is present.

O. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete building structure; in each conduit run which is mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit runs above ground which is more than one hundred feet long and interval between expansion fittings in such a run shall not be greater than 100 feet.

P. PVC joints shall be solvent welded. Threads will not be permitted on PVC conduit and fittings. Installation of PVC conduit shall be in accordance with manufacturer's recommendations. PVC conduit shall not be used to support fixture or equipment. Field bends shall be made with approved hotbox. Heating with flame and hand-held dryers are prohibited.

Q. Conduit installations on roofs shall be kept to a bare minimum. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Supports to be fastened to roof using roofing adhesive as approved by roofing contractor.

R. Cables in vertical raceways shall be supported as per NEC Article 300-19. Provide and install supporting devices for cables, including any necessary accessible pullbox as required regardless of whether shown on drawings or not. Provide and install access panels as required. Coordinate location of pull box and access panel with the Engineer before installation. This includes empty raceways for future use.

S. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls, etc., as required by NEC Article 300, whether shown on drawings or not.

T. Paint all field cut threads and coat all aluminum conduits in contact with concrete per manufacture’s recommendations.

U. Raceways that do not have conductors furnished under this Division of the Specifications shall be left with an approved nylon pullcord in the raceway.

V. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by approved ground bushings.

W. All aluminum conduits in contact with concrete shall be coated with bitumastic paint.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish, install, and test all wire, cable and appurtenances as shown on the Drawings and as hereinafter specified.

B. General Design

1. Wire for lighting and receptacle circuits in the administration building shall be type THHN solid.
2. Wire for all power feeder and motor circuits outside of the administration building shall be type THHN stranded.
3. Single conductor wire for control, indication and metering shall be type THHN No. 14 AWG, stranded.
4. Multi-conductor control cable shall be No. 14 AWG, stranded tinned copper.
5. Wire for process instrumentation shall be No. 16 AWG, stranded tinned copper.
6. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

1.02 QUALITY ASSURANCE

A. Standards

1. Insulated Cable Engineers Association (ICEA)
2. Underwriters Laboratories, Inc. (UL)
3. American Society of Testing and Materials (ASTM)

B. Manufacturers

1. 600-volt wire and cable:

a. Hi-Tech Cable Corp.
b. Collyer Insulated Wire Co.
c. Okonite Co.
d. Rome Cable Co.

e. American Insulated Wire Corp.
f. Triangle PWC, Inc., or equal.

2. Instrumentation and Control Cable:

a. American Insulated Wire Corp.
b. Rome Cable Corp.
c. Okonite Co.
d. Eaton Corp. “Polyset”.
e. Triangle PWC, Inc., or equal.

3. Federal Specifications (FS)

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All conductors shall be carefully handled to avoid kinks or damage to the insulation.

B. All conductors stored outdoors shall be covered.

PART 2 PRODUCTS

2.01 GENERAL

A. Wires and cables shall be of annealed, 98% conductivity, soft drawn copper conductors.

B. All conductors shall be stranded except lighting and receptacle circuits.

2.02 MATERIALS

A. 600-Volt Wire and Cable

1. Type THHN shall be polyvinyl chloride (PVC) insulation with nylon jacket.

B. Instrumentation and Control Cable

1. Process instrumentation wire shall be twisted pair, 600-volt, cross-linked polyethylene insulated, aluminum tape shielded, PVC jacketed, type "XLP". Multi-conductor cables with individually shielded twisted pairs shall be installed where indicated.
2. Multi-conductor control cable shall be stranded, 600-volt, cross-linked polyethylene insulated with PVC jacket, type "XLP".

C. Terminations and Splices

1. Unless otherwise indicated on the plans, no splices may be made in the cables without prior approval of the Engineer. Where splicing is approved, the splicing material shall be as recommended and approved by the cable manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. Lubrications shall be used to facilitate wire pulling. Lubricants shall be UL listed for use with the insulation specified.

C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

D. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from control cables in manholes.

E. Shielding on instrumentation wire shall be grounded at one end only as directed by the supplier of the instrument.

F. Wire and cable connections to terminals, splices, and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall not be less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

G. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or as approved by the Engineer.

H. Installed, unapproved wire shall be removed and replaced at no additional cost to the Owner.

I. Steel fish tapes and/or steel pulling cables shall not be used in PVC raceway systems.

J. Remove debris and moisture from the conduits, boxes, and cabinets before cable installation and mandrel with device of one size smaller than conduit and mandrel with wire brush one size larger than conduit.

3.02 TESTS

A. All 600-volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at not less than 1000-VDC. A cable test data form shall be provided for Engineer review.

B. All service conductors shall be tested as in Paragraph A above. These tests shall be witnessed by the Engineer.

END OF SECTION

SECTION 16130
BOXES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install all junction boxes, pull boxes, and service entrance boxes for a complete raceway system as shown on the Drawings and as specified herein.

B. General Design

1. Unless otherwise hereinafter specified or shown on the Drawings, all boxes and fasteners shall be type NEMA 4X, Type 316-stainless steel.
2. All boxes in air-conditioning plenums above ceilings shall be pressed steel.
3. All boxes that do not receive devices are to have blank plates installed matching wiring device plates.

1.02 QUALITY ASSURANCE

A. Standards

1. Underwriters Laboratories, Inc. (UL)
2. Federal Specifications (FS)
3. American Society of Testing and Materials (ASTM)
4. National Electrical Code (NEC)

B. Manufacturers

1. Hoffman, Type CHNFSS.
2. Or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. See Section 16050, Electrical – General Provisions.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Boxes and fittings shall be stored indoors protected from damage.

1.05 WARRANTY AND GUARANTEES

A. All boxes and fittings shall be warranted against defects or failure for a period of 1 year from date of acceptance.

PART 2 PRODUCTS

2.01 MATERIALS

A. Boxes shall be constructed as follows:

1. 14-gauge Type 316L stainless steel.
2. Continuously welded and ground smooth, no holes or knockouts.
3. Seamless foam in-place gasket, watertight, dust-tight.
4. Stainless steel screws and clamps.

PART 3 EXECUTION

3.01 INSTALLATION

A. All boxes shall be supported away from surfaces.

B. All boxes shall be sized in accordance with the National Electrical Code (NEC).

C. All conduit entries into boxes shall not lower or change the NEMA rating of the box.

END OF SECTION

SECTION 16140
WIRING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install wiring devices and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.

2. Wiring devices shall include the following:

a. Wall switches.
b. Device plates.
c. Plugs.
d. Receptacles.
e. Lighting control time clocks.
f. Lighting contactors.
g. Control stations.
h. Ground fault interrupter receptacles.

B. Related Work Described Elsewhere

1. Section 16050, Electrical – General Provisions.
2. Section 16110, Raceways and Fittings.

1.02 QUALITY ASSURANCE

A. Standards

1. Underwriters Laboratories, Inc. (UL)
2. National Electrical Manufacturers Association (NEMA)
3. National Electrical Code (NEC)
4. Federal Specifications (FS)

B. Manufacturers

1. Wall switches, device plates, plugs, and receptacles as follows:

a. Arrow-Hart.

b. Bryant.
c. Hubbell.
d. Leviton.
e. Or equal.

2. Clocks:

a. Simplex.
b. Or equal.

3. Lighting contactors:

a. Square-D.
b. Cutler-Hammer.
c. Or equal.

4. Dimmer controls:

a. Leviton.
b. Prescolite.
c. Or equal.

5. Control stations:

a. Hoffman Engineering Co.
b. Square-D.
c. Crouse-Hinds.
d. Or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Submit material list and catalog cut-sheets for all items covered under this Section. Indicate type, ratings, material, color, and manufacturer.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All devices covered under this Section shall be stored indoors, protected from damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Switches

1. Wall switches shall be of the indicating, toggle action, flush mounting quiet type. All switches shall conform to FS W-S-896-D.

2. Wall switches shall be of the following types and manufacturer or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary.

   a. Single-pole – Arrow-Hart, Catalog No. 1991.
   b. Double-pole – Arrow-Hart, Catalog No. 1992.
   c. Three-way – Arrow-Hart, Catalog No. 1993.
   d. Four-way – Arrow-Hart, Catalog No. 1994.
   e. Single-pole, key-operated – Arrow-Hart Catalog No. 11991-L.
   f. Momentary contact, two-circuit, center-off – Arrow-Hart, Catalog No. 1895.
   g. Weatherproof cover for Arrow-Hart 2900 series tap action switches – Arrow-Hart Catalog No. 2881-G.

B. Receptacles

1. Wall receptacles shall be of the following types and manufacturer or equal:

   a. Single, 20A, 125V, 1P, 3W – Arrow-Hart, Catalog No. 5351.
   b. Duplex, 20A, 125V, 1P, 3@ - Arrow-Hart, Catalog No. 5352.
   c. Weatherproof, 20A, 125V, 2P, 3W – Arrow-Hart, Catalog No. 5351 and WLRD-1 cover.
   d. Corrosion-resistant, duplex, 20A, 1 25V, 2P, 3W – Arrow-Hart, Catalog No. 5351 and WLRD-l cover.
   e. 60A, 480V, 3P, 2W – weatherproof receptacle shall be Crouse-Hinds Catalog No. ARE6324 with Crouse-Hinds Catalog No. APJ 6385 plug.
   f. Ground fault interrupter, duplex, 20A, 125V, 3P, 2W – Arrow-Hart Catalog No. GF5342.
   g. Stainless steel indoor mounting plate for G.F.I. receptacle – Arrow-Hart Catalog No. 97061.
   h. Weatherproof cover for G.F.I. receptacle in FS box – Arrow-Hart Catalog No. 4501-FS.

i. Clock hanger, 15A, 125V, 2P, 3DW – Arrow-Hart Catalog No. 452.
j. Single, 20A, 125V, 2P, 3W – Arrow-Hart Catalog No. 8510BL; cover – Arrow-Hart Catalog No. 9301C indoor, 7420C weatherproof.
k. Single, 30A, 125V, 2P, 3W – Arrow-Hart Catalog No. 5716N; cover – Arrow-Hart Catalog No. 9301C indoor, 7420C weatherproof.
l. Clothes dryer, 30A, 125/250V, 3P, 3W – Arrow-Hart Catalog No. 9344N. Matching cord set shall also be included.

C. Device Plates

1. Plates for flush mounted devices shall be of the required number of gangs for the application involved and shall be Type 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

D. Lighting Contactor

1. Lighting contactors shall be of the electrically operated, electrically held type in NEMA 1 enclosures of the number of poles as called for on the Drawings.
2. Contactors shall be rated for 25A 600-volt contacts and be similar and equal to Automatic Switch Company bulletin 1255-166 RC.

E. Lighting Control Time Switches

1. Time switches for the control of lighting shall have astronomic dials, reserve power, and be similar and equal to the following types:

a. Where time switch is indicated to be for momentary contact operation it shall be similar and equal to Intermatic Inc. Catalog No. ET-70115-C.
b. Where time switch is indicated for SPST maintained control it shall be similar and equal to Intermatic Inc. Catalog No. V-45471-CR.
c. Where time switch is indicated for DPST maintained control it shall be similar and equal to Intermatic Inc. Catalog No. V-45471-CR.
d. Where time switch is indicated for roadway or equipment, lighting shall be similar or equal to Intermatic Inc. Catalog No. ET-7000 Series.

F. Control Stations

1. Control stations for start/stop pushbutton and hand-off-automatic selector switches shall be corrosion resistant, dust-tight, watertight, and weatherproof, NEMA 4X, 600 VAC, UL Standard 508 as manufactured by Crouse-Hinds Series NCS or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Receptacles in process areas and shops shall be mounted 36 inches above the floor unless otherwise noted on the Drawings.

B. Receptacles in office and other like areas shall be mounted 18 inches above the floor unless otherwise noted on the Drawings.

C. Use bolt, screws, nuts, and other threaded devices having standard threads and heads so they may be installed and replaced without special tools.

D. Check light switch locations before rough-in to avoid installing a switch behind the door swing.

E. The Engineer and Owner reserve the right to change any switch or receptacle location within the same room, without added cost before rough-in.

F. Locate outlets intended for the supply of specific items such as water coolers, copying machines, fans, etc., as recommended by the item manufacturer.

END OF SECTION

SECTION 16170
SAFETY SWITCHES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install all motor and circuit disconnects as hereinafter specified and as shown on the Drawings.

B. General Design

1. All switches shall be heavy duty and have stainless steel NEMA 4X enclosures and be horsepower rated.
2. All switches shall have metal nameplates, front cover mounted that contain a permanent load, switch-type, catalog number, and HP ratings, handle whose position is easily recognizable and is padlockable in the "off" position, visible blades, reinforced fuse clips, nonteasible, positive, quick make-quick break mechanism, switch assembly plus operating handle as an integral part of the enclosure base.
3. Switches shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the "on" position. All switches shall have line terminal shields.
4. All current carrying parts shall be copper.
5. Auxiliary contacts rated 10 ampere at 240 volts shall be provided for motor space heater interlock and position indication.

1.02 QUALITY ASSURANCE

A. Standards

1. National Electrical Manufacturers Association (NEMA)
2. Underwriters Laboratories (UL)
3. Federal Specifications (FS)
4. National Electrical Code (NEC)

B. Manufacturers

1. Switches shall be as manufactured by Square D Co. Class 9422, Cutler-Hammer, or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. See Section 16050, Electrical – General Provisions.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All switches shall be stored indoors protected from damage.

1.05 WARRANTY AND GUARANTEES

A. All switches shall be warranted against defect, rusting, or failure for a period of 1 year from date of acceptance.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Where a six-pole weatherproof disconnect are called for on the Drawings, the Contractor shall provide two 600-Volt, three-pole non-fusible switches in a single NEMA 4X stainless steel enclosure with a single operating handle mechanically interlocked to both disconnects.

B. All parts exposed to the weather or in hose-down areas shall be stainless steel.

C. Short-circuit rating – 10,000 RMS symmetrical amperes for non-fused switches.

D. Line and load lugs shall be front removable and suitable for copper, 60/75-degree C wire through 200A sizes, 75-degree C wire for 400-800A sizes.

PART 3 EXECUTION

3.01 INSTALLATION

A. All switches shall be mounted as shown on the Drawings.

B. Location of disconnect switches shall be in accordance with the NEC and shall be verified with the Engineer before installation.

C. All mounting appurtenances shall be Type 316 stainless steel including fasteners.

END OF SECTION

SECTION 16450
GROUNDING SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

B. Related Work Described Elsewhere

1. Section 16120, Wires and Cables.
2. Section 16110, Raceways and Fittings.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:

   a. Certified shop drawings with performance data and physical characteristics.
   b. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
   c. All information required by Section 01330, Submittals and Acceptance.

d. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between system and connections to work of other sections.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver a complete system ready to install as job progress requires.

PART 2 PRODUCTS

2.01 GENERAL

A. The Specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishings, delivery, installation, and field testing of all materials, equipment, and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these Specifications or shown on the Drawings shall be furnished and installed.

B. The material covered by these Specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS AND EQUIPMENT

A. Ground rods: Ground rods shall be copper clad steel 3/4-inch x 20-foot, minimum depth. Ground rods shall be copperweld or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. The 480-volt switchgear ground bus shall be grounded to a ground loop system. The protecting conduits shall be bonded to the grounding conductor at both ends.

B. All steel building columns shall be bonded together and connected to the building ground grid.

C. Motors shall be grounded as hereinafter specified.

D. Lighting transformer neutrals shall be grounded to the nearest grounding electrode.

E. Grounding electrodes shall be driven as required. Where rock is encountered, grounding plates may be used in lieu of grounding rods.

F. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel, and similar items shall be grounded.

G. Exposed connections shall be made by means of approved grounding clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A or equal. All buried connections shall be made by welding process such as Cadweld or equal.

H. For reasons of mechanical strength, grounding conductors shall be No. 10 AWG minimum copper, minimum size.

I. All underground conductors shall be laid slack and where exposed to mechanical injury, shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard.

J. The Contractor shall exercise care to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

3.02 INSPECTION AND TESTING

A. The Contractor shall obtain the services of an NETA recognized testing firm to measure the ground resistance of the system. All test equipment shall be provided by the Contractor and approved by the Engineer. Dry season resistance of the system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, the Contractor shall provide additional grounding as directed by the Engineer, without additional payment.

END OF SECTION

SECTION 16900
SCREW PUMP LIFT STATION CONTROL PANEL

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish, install, and test the three control panels as hereinafter specified and as shown on the electrical drawings.

1.02 QUALITY ASSURANCE

A. Standards

1. National Electric Code (NEC).
2. Underwriters Laboratories (UL).

B. Equipment Manufacturers

1. Rocha Controls
2. Revere Controls

1.03 SUBMITTALS

A. Submit detailed drawings concerning each control panel and all components including:

1. Cabinet assembly and layout drawings to scale.
2. Fabrication specifications with materials of construction of all components.
3. Point-to-point wiring diagrams depicting wiring within the panel and connection to external devices. Free-hand drawings are unacceptable.
4. Catalog cut sheets on all panel components with manufacturer's complete model number.

B. The data sheet and drawings shall be provided with an index and proper identification and cross-referencing. Each control panel shall be submitted in its entirety.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. After completion of shop assembly, factory test, and approval, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in

heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at job site.

B. Special instructions for proper field handling, storage and installation required by the Manufacturer for proper protection, shall be securely attached to each piece of equipment prior to packaging and shipment.

C. Each component shall be tagged to identify its location, tag number, and function in the system. Identification shall be prominently displayed on the outside of the package.

D. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and shall be adequately protected against mechanical injury. If any apparatus has been damaged, the Contractor at his own cost and expense shall repair such damage. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Contractor, or the Contractor at his own expense shall replace the apparatus.

1.05 WARRANTY AND GUARANTEES

A. The equipment manufacturer shall warrant the units being supplied to the Owner against defects in workmanship and materials for a period of 1 year from the date of equipment start-up and acceptance. If the equipment fails to perform as specified, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner.

PART 2 PRODUCTS

2.01 GENERAL

A. This Section specifies the control system requirements for recycling pumps. The minimum horsepower rating of pump station control panels shall be as shown on the plans. The panel shall be UL certified per 508a and withstand 22 kAIC SCCR.

B. The control panel shall contain switches and relays that automatically start and stop pumps as well as transmit an alarm upon starter failure. The control panel shall operate one (1) pump. The control panel shall provide relay connections to the City’s telemetry system for monitoring and off-site control of the pump.

C. All components shall be mounted in a manner that shall permit servicing, adjustment, testing, and removal without disconnecting, moving, or removing any other component. Components mounted on the inside of panels shall be mounted on a back plate and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with the component manufacturers and industry standard practices. All internal components shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component identifying the component in accordance with the drawings, specifications, and supplier's data.

D. The control panel shall consist of a main breaker with a flange type disconnect, plus 20 amperes rated for 120-volt branch circuits related to controls and a remote 1/3-HP, 115-volt grease pump, as required. Control switches shall provide means to operate pump manually or automatically.

E. Control Panel Construction

1. Panel Details:

a. The control panel shall be housed in a NEMA 4, 12-gauge painted steel enclosure with extra mounting space for additional equipment. The enclosure shall provide pad locking the door and #11-gauge aluminum inner door for mounting control devices. The panels shall be wired and assembled per UL 508 Standards. All electrical components and materials shall be listed by UL and shall bear the appropriate UL listing mark or classification. Each panel shall be listed and labeled as UL 508 Industrial MCC. Panels shall comply with NFPA 79, Industrial Machinery. A permanent, non-paper wiring diagram shall be mounted on the inside of the cabinet door.

b. There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10-inch-by-12-inch pocket for log storage. The nameplate shall contain the voltage, phase, rated horsepower, speed, date of manufacture, pump and panel manufacturer's name, address and telephone number, pump data.

c. Panel mounted controls and indicators shall maintain panel integrity. Suitable stiffness shall be provided when required to maintain flatness and provide extra rigidity.

d. Terminal blocks shall be separated into groups (power, AC control, DC signal, data, etc.). All terminals shall be marked with legible permanent labels or otherwise identified.

e. The control panel shall include at a minimum: a grease pump circuit breaker.

f. Surge protector equipment in accordance with UL 1449 Standards shall be installed on the load side of the main circuit breaker for protection of all AC electrical equipment in the control panel and the motors from the effects of lightning induced currents, substation switching transients, and internally generated transients.

2. Motor Starters:

a. Soft Starter Solid State:

(1) Solid-state reduced voltage starters shall be digitally controlled to provide smooth, stepless acceleration of three-phased induction squirrel cage motors. This shall be accomplished by use of six back-to-back SCR's connected in reverse parallel arrangement, mounted on a common heat sink. The starter shall provide an adjustable smooth acceleration and deceleration.

(2) Each starter pole shall contain two SCR's with sequentially fired phase-controlled circuit. Each starter shall include an integral thermal sensor to trip and disengage starter on heat sink overtemperature. Starter shall use digital microprocessor. Starter shall include programmable keypad and alphanumeric LED display that actively indicates present mode of operations. Starter shall include error tractability (of last four events) for taking equipment corrective actions.

(3) Solid-state reduced voltage starters shall be listed and/or classified by Underwriters Laboratories UL 508, UL 845, and ISO 9000 compliant.

(4) Solid state starters shall be manufactured by Square-D Altistart 22 or Allen-Bradley SMC-3.

3. Circuit Breakers:

a. All circuit breakers shall have an appropriate locking device to meet OSHA lockout and tag-out rules. All circuit breakers shall be heavy duty molded case breakers rated 22 KAIC. The handle on the circuit breakers shall be operational through the inner door.

b. Dedicated Branch Breakers:

(1) Grease pump.

(2) Controls.

4. Control Relays:

    a. The control relays shall operate from a 24-volt circuit. The relays shall be enclosed, eight-pin and/or eleven-pin plug-in type. The control relays shall contain test button and neon or LED energized indicator. The plug base shall be keyed to allow for proper pin alignment.

5. Control Relay Sockets:

    a. Control relay sockets shall be octal style with clamp on screw terminals. These sockets shall be 600 VAC rated and mounted on DIN railing. All relay sockets shall be keyed to allow for proper pin alignment.

6. Control Terminal Blocks:

    a. Control terminal blocks shall be clamp screw type and rated for 600 volts. The amperage rating of control terminal blocks shall accommodate the amperage of the circuit to which it is connected but have a minimum rating of 20 amps. An additional 30-space terminal strip shall be installed in the panel for future expansion.

7. Control Power Transformers:

    a. The 480-120 VAC transformer shall be a properly sized capable of meeting the needs of the control system and grease pump. The transformer shall contain a fused secondary. In 480-volt AC applications, a fused control circuit transformer shall be supplied to provide 120 volts AC auxiliary equipment power. The power transformer shall be dry and properly fused on both the primary and secondary side of the transformer.

8. Selector Switches:

    a. Selector switches shall be installed on the face of the inner door unit. Selector switches shall contain heavy duty "Hand-Off-Auto" three position switches to control the operation mode of each pump motor starter.

9. Indicator Lights:

    a. On the face of the inner door unit, heavy duty LED indicator lights shall be installed. The lights shall indicate the control status of the

float control switches, the run condition of the pumps and the condition of the moisture sensor in each pump. The indicator lights shall be 120-volt.

10. Elapsed Time Meters:

    a. Elapsed time meters shall be mounted on the face of the inner door unit with one for each pump. These meters shall be 115-volt non-resettable type and totalize pump-running time in hours and tenths of hours to 99999.9 hours. Elapsed Time Meter:
    ETMAC 200-10NG7 Round Mount.

11. Convenience Receptacle:

    a. A 15-amp, 120-volt, duplex convenience receptacle shall be installed on the face of the inner door unit. The receptacle shall contain a single pole, 15-amp circuit breaker for protection. Ground fault interrupt type shall be required.

12. Wiring:

    a. All power wires shall be THW, or THWN 75-degree C insulated stranded copper conductors and appropriately sized for the load application. All control circuit wire shall be Type THW, 14 AWG, stranded type copper. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers. Wiring on the rear of the inner door shall be neatly bundled with spiral wiring loom and include a sufficient loop across the hinges to prevent wire binding or damage. Both ends of each conductor shall be permanently identified. Color-coding of all wiring is required: RED = 24VAC+; WHITE = Neutral; BLACK = 102VAC+; PURPLE = 12VDC+; GREY = 12VDC-; and GREEN = Equipment Ground.

13. Terminal Points:

    a. Terminal points of all terminal strips, relays and components shall be permanently identified. All terminal numbers, wire numbers and identifying nomenclature shall correspond to and be shown on electrical schematic diagrams.

14. Nameplates and Labels:

    a. All circuit breakers, control switches, indicator lights, relays, and other control devices shall be identified with permanently affixed

legend plates and lamicoid-type engraved nameplates where applicable. A black and red on white label stating "DANGER, HIGH VOLTAGE, 240 or 480 (use applicable) VOLTS" shall be affixed to the face of the inner door unit.

15. Documentation:

    a. The panel manufacturer shall furnish a list of components used in the construction of the panel. The list shall include renewal kits needed such as starter contacts, coils, bulbs, relays, alternators, switches and sockets. The list shall include manufacturer of the part, model number and part number.

16. Spare Parts:

    a. The manufacturer shall furnish the following spare parts for each panel supplied:

        (1) Five fuses of each size and type used.
        (2) Five bulbs of each size and type used.

    b. Spare parts shall be properly packaged and labeled for easy identification without opening the package and delivered at pump station start-up.

17. Electrical Schematic:

    a. An electrical schematic diagram shall be permanently affixed to the interior side of the exterior enclosure door with a copy supplied to the Owner personnel at start-up. The schematic diagram shall include the rated amperage and voltage for all components.

F. Functional Control Descriptions

1. Internal Recycle Pump:

    a. Each control panel shall allow for the manual and automatic control of the pump via a remote PLC and SCADA system. The automation is in the remote PLC.
    b. The HAND position shall start the pump if the local e-stop pushbuttons are not active.
    c. The OFF position will not allow the pump to run.

2. Grease Pump:

a. The grease pump shall run in unison with the recycling pump.

PART 3 EXECUTION

3.01 INSPECTION AND TESTING

A. The control panel manufacturer shall provide 2 days of start-up and testing services for the installed and completed installation. The services shall include all required adjustments of field and panel devices pertinent to the supplied control panel.

END OF SECTION

SECTION V

CONTRACT DOCUMENTS

Table of Contents

PUBLIC CONSTRUCTION BOND 1
CONTRACT 4
CONSENT OF SURETY TO FINAL PAYMENT 8
PROPOSAL/BID BOND 9
AFFIDAVIT 10
NON-COLLUSION AFFIDAVIT 11
PROPOSAL 12
CITY OF CLEARWATER ADDENDUM SHEET 14
BIDDER'S PROPOSAL 15
SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH CUBA AND SYRIA CERTIFICATION FORM 17
SCRUTINIZED COMPANIES THAT BOYCOTT ISRAEL LIST CERTIFICATION FORM 18

Bond No.: _____

PUBLIC CONSTRUCTION BOND

(1)

This bond is given to comply with § 255.05, Florida Statutes, and any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in subsections (2) and (10).

Pursuant to § 255.05(1)(b), Florida Statutes, "**Before commencing the work** or before recommencing the work after a default or abandonment, **the contractor shall provide to the public entity a certified copy of the recorded bond**. Notwithstanding the terms of the contract or any other law governing prompt payment for construction services, the public entity may not make a payment to the contractor until the contractor has complied with this paragraph."

CONTRACTOR	SURETY	OWNER
[*name*]	[*name*]	City of Clearwater Public Utilities Engineering 100 S. Myrtle Avenue Clearwater, FL 33756 (727) 562-4750
[*principal business address*]	[*principal business address*]	
[*phone number*]	[*phone number*]	

PROJECT NAME: **East Water Reclamation Facility Screw Pump**

PROJECT NO.: **22-0028-UT**

PROJECT DESCRIPTION: Replace three existing open screw pumps, grease pumps, motors, and appurtenances as required by the Contract Documents. Refurbish the existing three slide gates located adjacent to the existing screw pumps as required by the Contract Documents. Modify the existing electrical system including new electrical conduit, wire, starter panels; modify the existing motor control center; reconnect proposed signal wiring to the existing control panel and supervisory control and data acquisition (SCADA) system to match the existing; and other improvements to the screw pumps as required by the Contract Documents. Provide coating systems as indicated in the Contract Documents and expansion joint and crack injection repair on the screw pump concrete structure. Any other items indicated within the Contract Documents.

BY THIS BOND, We, _____, as Contractor, and _____, a corporation, as Surety, are bound to the City of Clearwater, Florida, herein called Owner, in the sum of $[x,xxx,xxx.xx], for payment of which we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally.

THE CONDITION OF THIS BOND is that if Contractor:

1. Performs the contract dated _____, between Contractor and Owner for construction of **East Water Reclamation Facility Screw Pump** the contract documents being made a part of this bond by reference (which include the Advertisement for Bids, Proposal, Contract, Surety Bond,

Instructions to Bidders, General Conditions, Plans, Technical Specifications and Appendix, and such alterations as may be made in said Plans and Specifications as therein provided for), at the times and in the manner prescribed in the contract; and

2. Promptly makes payments to all claimants, as defined in Section 255.05(1), Florida Statutes, supplying Contractor with labor, materials, or supplies, used directly or indirectly by Contractor in the prosecution of the work provided for in the contract; and

Bond No.:_____

PUBLIC CONSTRUCTION BOND
(2)

3. Pays Owner all losses, damages, expenses, costs, and attorney's fees, including appellate proceedings, that Owner sustains because of a default by Contractor under the contract; and
4. To the limits of § 725.06(2), Florida Statutes, shall indemnify and hold harmless Owner, their officers and employees, from liabilities, damages, losses and costs, including, but not limited to, reasonable attorney's fees, to the extent caused by the negligence, recklessness, or intentional wrongful misconduct of Contractor and persons employed or utilized by Contractor in the performance of the construction contract; and
5. Performs the guarantee of all work and materials furnished under the contract for the time specified in the contract, then this bond is void; otherwise, it remains in full force.
6. Any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in Section 255.05(2), Florida Statutes.
7. Any changes in or under the contract documents and compliance or noncompliance with any formalities connected with the contract or the changes does not affect Surety's obligation under this bond, and Surety does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

IN TESTIMONY WHEREOF, witness the hands and seals of the parties hereto this _____ day of _____, 20___.

(If sole Ownership or Partnership, two (2) Witnesses required).
(If Corporation, Secretary only will attest and affix seal).

[TYPE LEGAL NAME OF CONTRACTOR]

By: _____
Title: _____
Print Name: _____

WITNESS:

_____
Corporate Secretary or Witness
Print Name: _____

(affix corporate seal)

WITNESS:

_____
Print Name: _____

_____
(Corporate Surety)

By: _____
ATTORNEY-IN-FACT
Print Name: _____

(affix corporate seal)

(Power of Attorney must be attached)

CONTRACT

(1)

This **CONTRACT** made and entered into this ___ day of _____, 20___ by and between the City of Clearwater, Florida, a municipal corporation, hereinafter designated as the "City", and _____, of the City of _____ County of _____ and State of Florida, hereinafter designated as the "Contractor".

[Or, if out of state:]

This **CONTRACT** made and entered into this ___ day of _____, 20___ by and between the City of Clearwater, Florida, a municipal corporation, hereinafter designated as the "City", and _____, a/an _____(State) Corporation authorized to do business in the State of Florida, of the City of _____ County of _____ and State of _____, hereinafter designated as the "Contractor".

WITNESSETH:

That the parties to this contract each in consideration of the undertakings, promises and agreements on the part of the other herein contained, do hereby undertake, promise and agree as follows:

The Contractor, and his or its successors, assigns, executors or administrators, in consideration of the sums of money as herein after set forth to be paid by the City and to the Contractor, shall and will at **their** own cost and expense perform all labor, furnish all materials, tools and equipment for the following:

PROJECT NAME: **East Water Reclamation Facility Screw Pump**

PROJECT NO.: **22-0028-UT**

in the amount of $_____

In accordance with such proposal and technical supplemental specifications and such other special provisions and drawings, if any, which will be submitted by the City, together with any advertisement, instructions to bidders, general conditions, technical specifications, proposal and bond, which may be hereto attached, and any drawings if any, which may be herein referred to, are hereby made a part of this contract, and all of said work to be performed and completed by the contractor and its successors and assigns shall be fully completed in a good and workmanlike manner to the satisfaction of the City.

If the Contractor should fail to comply with any of the terms, conditions, provisions or stipulations as contained herein within the time specified for completion of the work to be performed by the Contractor, then the City, may at its option, avail itself of any or all remedies provided on its behalf and shall have the right to proceed to complete such work as Contractor is obligated to perform in accordance with the provisions as contained herein.

CONTRACT
(2)

THE CONTRACTOR AND HIS OR ITS SUCCESSORS AND ASSIGNS DOES HEREBY AGREE TO ASSUME THE DEFENSE OF ANY LEGAL ACTION WHICH MAY BE BROUGHT AGAINST THE CITY AS A RESULT OF THE CONTRACTOR'S ACTIVITIES ARISING OUT OF THIS CONTRACT AND FURTHERMORE, IN CONSIDERATION OF THE TERMS, STIPULATIONS AND CONDITIONS AS CONTAINED HEREIN, AGREES TO HOLD THE CITY FREE AND HARMLESS FROM ANY AND ALL CLAIMS FOR DAMAGES, COSTS OF SUITS, JUDGMENTS OR DECREES RESULTING FROM ANY CLAIMS MADE UNDER THIS CONTRACT AGAINST THE CITY OR THE CONTRACTOR OR THE CONTRACTOR'S SUB CONTRACTORS, AGENTS, SERVANTS OR EMPLOYEES RESULTING FROM ACTIVITIES BY THE AFOREMENTIONED CONTRACTOR, SUB CONTRACTOR, AGENT SERVANTS OR EMPLOYEES, TO THE LIMITS OF § 725.06(2).

In addition to the foregoing provisions, the Contractor agrees to conform to the following requirements:

In connection with the performance of work under this contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, sex, religion, color, or national origin. The aforesaid provision shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; lay off or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post hereafter in conspicuous places, available for employees or applicants for employment, notices to be provided by the contracting officer setting forth the provisions of the non-discrimination clause.

The Contractor further agrees to insert the foregoing provisions in all contracts hereunder, including contracts or agreements with labor unions and/or worker's representatives, except sub-contractors for standard commercial supplies or raw materials.

It is mutually agreed between the parties hereto that time is of the essence of this contract, and in the event that the work to be performed by the Contractor is not completed within the time stipulated herein, it is then further agreed that the City may deduct from such sums or compensation as may be due to the Contractor the sum of **$1,000.00 per day** for each day that the work to be performed by the Contractor remains incomplete beyond the time limit specified herein, which sum of **$1,000.00 per day** shall only and solely represent damages which the City has sustained by reason of the failure of the Contractor to complete the work within the time stipulated, it being further agreed that this sum is not to be construed as a penalty but is only to be construed as liquidated damages for failure of the Contractor to complete and perform all work within the time period as specified in this contract.

It is further mutually agreed between the City and the Contractor that if, any time after the execution of this contract and the public construction bond which is attached hereto for the faithful performance of the terms and conditions as contained herein by the Contractor, that the City shall at any time deem the surety or sureties upon such public construction bond to be unsatisfactory or if, for any reason, the said bond ceases to be adequate in amount to cover the performance of the work the Contractor shall, at his or its own expense, within ten (10) days after receipt of written notice from the City to do so, furnish an additional bond or bonds in such term and amounts and with such surety or sureties as shall be satisfactory to the City. If such an event occurs, no further payment shall be made to the Contractor under the terms and provisions of this contract until such new or additional security bond guaranteeing the faithful performance of the work under the terms hereof shall be completed and furnished to the City in a form satisfactory to it.

CONTRACT
(3)

In addition to all other contract requirements as provided by law, the contractor executing this agreement agrees to comply with public records law.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, THE CONTRACTORS DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT. CONTACT THE CUSTODIAN OF PUBLIC RECORDS, Rosemarie Call, City Clerk, AT Rosemarie.Call@myclearwater.com, 727-562-4092, 600 Cleveland St. Clearwater, FL 33756.

The contractor's agreement to comply with public records law applies specifically to:

a) Keep and maintain public records required by the City of Clearwater (hereinafter "public agency") to perform the service being provided by the contractor hereunder.

b) Upon request from the public agency's custodian of public records, provide the public agency with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided for in Chapter 119, Florida Statutes, as may be amended from time to time, or as otherwise provided by law.

c) Ensure that the public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the contractor does not transfer the records to the public agency.

d) Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of the contractor or keep and maintain public records required by the public agency to perform the service. If the contractor transfers all public records to the public agency upon completion of the contract, the contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the contractor keeps and maintains public records upon completion of the contract, the contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the public agency, upon request from the public agency's custodian of public records, in a format that is compatible with the information technology systems of the public agency.

e) A request to inspect or copy public records relating to a public agency's contract for services must be made directly to the public agency. If the public agency does not possess the requested records, the public agency shall immediately notify the contractor of the request and the contractor must provide the records to the public agency or allow the records to be inspected or copied within a reasonable time.

f) The contractor hereby acknowledges and agrees that if the contractor does not comply with the public agency's request for records, the public agency shall enforce the contract provisions in accordance with the contract.

g) A contractor who fails to provide the public records to the public agency within a reasonable time may be subject to penalties under Section 119.10, Florida Statutes.

h) If a civil action is filed against a contractor to compel production of public records relating to a public agency's contract for services, the court shall assess and award against the contractor the reasonable costs of enforcement, including reasonable attorney fees, if:

1. The court determines that the contractor unlawfully refused to comply with the public records request within a reasonable time; and

CONTRACT
(4)

2. **At least 8 business days before filing the action, the plaintiff provided written notice of the public records request, including a statement that the contractor has not complied with the request, to the public agency and to the contractor.**

i) **A notice complies with subparagraph (h)2. if it is sent to the public agency's custodian of public records and to the contractor at the contractor's address listed on its contract with the public agency or to the contractor's registered agent. Such notices must be sent by common carrier delivery service or by registered, Global Express Guaranteed, or certified mail, with postage or shipping paid by the sender and with evidence of delivery, which may be in an electronic format.**

j) **A contractor who complies with a public records request within 8 business days after the notice is sent is not liable for the reasonable costs of enforcement.**

IN WITNESS WHEREOF, the parties to the agreement have hereunto set their hands and seals and have executed this Agreement, the day and year first above written.

CITY OF CLEARWATER
IN PINELLAS COUNTY, FLORIDA

By: _____ (SEAL)
Jennifer Poirrier
City Manager

Attest:

Countersigned:

_____
Rosemarie Call
City Clerk

By: _____
Frank Hibbard
Mayor

Approved as to form:

_____
Owen Kohler
Assistant City Attorney

Contractor must indicate whether:
_____ Corporation, _____ Partnership, _____ Company, or _____ Individual

_____
(Contractor)

By: _____ (SEAL)
Print Name: _____
Title: _____

The person signing shall, in his own handwriting, sign the Principal's name, his own name, and his title; where the person is signing for a Corporation, he must, by Affidavit, show his authority to bind the Corporation – **provide Affidavit**.

CONSENT OF SURETY TO FINAL PAYMENT

TO OWNER:	City of Clearwater	PROJECT NAME: **East Water Reclamation Facility Screw Pump**
	Public Utilities Engineering	PROJECT NO.: **22-0028-UT**
	100 S. Myrtle Ave.	CONTRACT DATE: [_____]
	Clearwater, FL 33756	BOND NO.: [_____], recorded in O.R. Book [____], Page [____], of the Public Records of Pinellas County, Florida.

CONTRACTOR: [_____]

Pursuant to § 255.05(11), Florida Statutes, and in accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the:

[insert name of Surety]
[address]
[address] ,SURETY,

on bond of

[insert name of Contractor]
[address]
[address] ,CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve Surety of any of its obligations to

City of Clearwater
Public Utilities Engineering
100 S. Myrtle Ave.
Clearwater, FL 33756 ,OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand this ___ day of _____, _____

_____
(Surety)

_____
(Signature of authorized representative)

_____
(Printed name and title)

Attest:
(Seal):

PROPOSAL/BID BOND

(Not to be filled out if a certified check is submitted)

KNOWN ALL MEN BY THESE PRESENTS: That we, the undersigned, _____ _____ as Contractor, and _____ _____ as Surety, whose address is _____ _____, are held and firmly bound unto the City of Clearwater, Florida, in the sum of _____ Dollars ($_____) (being a minimum of 10% of Contractor's total bid amount) for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the attached Proposal of _____ _____ as Contractor, and _____ as Surety, for work specified as: _____ _____ all as stipulated in said Proposal, by doing all work incidental thereto, in accordance with the plans and specifications provided herefor, all within Pinellas County, is accepted and the contract awarded to the above named bidder, and the said bidder shall within ten days after notice of said award enter into a contract, in writing, and furnish the required Public Construction Bond with surety or sureties to be approved by the City Manager, this obligation shall be void, otherwise the same shall be in full force and virtue by law and the full amount of this Proposal/Bid Bond will be paid to the City as stipulated or liquidated damages.

Principal must indicate whether:
_____ Corporation, _____ Partnership, _____ Company, or _____ Individual

Signed this _____ day of _____, 20____.

_____
Contractor

_____
Principal

By: _____
Title

_____

_____
Surety

The person signing shall, in his own handwriting, sign the Principal's name, his own name, and his title; where the person is signing for a Corporation, he must, by Affidavit, show his authority to bind the Corporation – **provide Affidavit**.

AFFIDAVIT

(To be filled in and executed if the bidder is a corporation)

STATE OF FLORIDA)

COUNTY OF _____)

_____, being duly sworn, deposes and says that he/she is Secretary of _____
a corporation organized and existing under and by virtue of the laws of the State of Florida, and having its principal office at:

_____ _____ _____ _____
(Street & Number) (City) (County) (State)

Affiant further says that he is familiar with the records, minute books and by-laws of

_____
(Name of Corporation)

Affiant further says that _____ is _____
(Officer's Name) (Title)

of the corporation, is duly authorized to sign the Proposal for _____

or said corporation by virtue of _____
(state whether a provision of by laws or a Resolution of Board of Directors. If by Resolution give date of adoption).

_____

_____
Affiant

Sworn to before me this _____ day of _____, 20____.

_____
Notary Public

_____
Type/print/stamp name of Notary

_____
Title or rank, and Serial No., if any

NON-COLLUSION AFFIDAVIT

STATE OF FLORIDA)

COUNTY OF _____)

_____ being, first duly sworn, deposes and says that he is

_____ of _____,
the party making the foregoing Proposal or Bid; that such Bid is genuine and not collusive or sham: that said bidder is not financially interested in or otherwise affiliated in a business way with any other bidder on the same contract; that said bidder has not colluded, conspired, connived, or agreed, directly or indirectly, with any bidders or person, to put in a sham bid or that such other person shall refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any person, to fix the bid price or affiant or any other bidder, or to fix any overhead, profit or cost element of said bid price, or that of any other bidder, or to secure any advantage against the City of Clearwater, Florida, or any person or persons interested in the proposed contract; and that all statements contained in said proposal or bid are true; and further, that such bidder has not directly or indirectly submitted this bid, or the contents thereof, or divulged information or data relative thereto to any association or to any member or agent thereof.

_____
Affiant

Sworn to and subscribed before me this _____ day of _____, 20____.

_____
Notary Public

PROPOSAL

(1)

TO THE CITY OF CLEARWATER, FLORIDA, for

East Water Reclamation Facility Screw Pump 22-0028-UT

and doing such other work incidental thereto, all in accordance with the contract documents, marked

East Water Reclamation Facility Screw Pump 22-0028-UT

Every bidder must take notice of the fact that even though his proposal be accepted and the documents signed by the bidder to whom an award is made and by those officials authorized to do so on behalf of the City of Clearwater, Florida, that no such award or signing shall be considered a binding contract without a certificate from the Finance Director that funds are available to cover the cost of the work to be done, or without the approval of the City Attorney as to the form and legality of the contract and all the pertinent documents relating thereto having been approved by said City Attorney; and such bidder is hereby charged with this notice.

The signer of the Proposal, as bidder, also declares that the only person, persons, company or parties interested in this Proposal, are named in this Proposal, that he has carefully examined the Advertisement, Instructions to Bidders, Contract Specifications, Plans, Supplemental Specifications, General Conditions, Special Provisions, and Public Construction Bond, that he or his representative has made such investigation as is necessary to determine the character and extent of the work and he proposes and agrees that if the Proposal be accepted, he will contract with the City of Clearwater, Florida, in the form of contract; hereto annexed, to provide the necessary labor, materials, machinery, equipment, tools or apparatus, do all the work required to complete the contract within the time mentioned in the General Conditions and according to the requirements of the City of Clearwater, Florida, as herein and hereinafter set forth, and furnish the required surety bonds for the following prices to wit:

If the foregoing Proposal shall be accepted by the City of Clearwater, Florida, and the undersigned shall fail to execute a satisfactory contract as stated in the Advertisement herein attached, then the City may, at its option determine that the undersigned has abandoned the contract, and thereupon this Proposal shall be null and void, and the certified check or bond accompanying this Proposal, shall be forfeited to become the property of the City of Clearwater, Florida, and the full amount of said check shall be retained by the City, or if the Proposal Bond be given, the full amount of such bond shall be paid to the City as stipulated or liquidated damages; otherwise, the bond or certified check accompanying this Proposal, or the amount of said check, shall be returned to the undersigned as specified herein.

PROPOSAL

(2)

Attached hereto is a bond or certified check on _____

_____ Bank, for the sum of _____

_____ ($_____)
(being a minimum of 10% of Contractor's total bid amount).

The full names and residences of all persons and parties interested in the foregoing bid are as follows:

(If corporation, give the names and addresses of the President and Secretary. If firm or partnership, the names and addresses of the members or partners. The Bidder shall list not only his name but also the name of any person with whom bidder has any type of agreement whereby such person's improvements, enrichment, employment or possible benefit, whether sub-contractor, materialman, agent, supplier, or employer is contingent upon the award of the contract to the bidder).

NAMES:	ADDRESSES:
_____	_____
_____	_____
_____	_____
_____	_____

Signature of Bidder: _____

The person signing shall, in his own handwriting, sign the Principal's name, his own name and his title. Where the person signing for a corporation is other than the President or Vice President, he must, by affidavit, show his authority, to bind the corporation.

Principal: _____

By: _____ Title: _____

Company Legal Name: _____

Doing Business As (if different than above): _____

Business Address of Bidder: _____

City and State: _____ Zip Code _____

Phone: _____ Email Address: _____

Dated at _____, this _____ day of _____, A.D., 20__.

CITY OF CLEARWATER
ADDENDUM SHEET

PROJECT: East Water Reclamation Facility Screw Pump 22-0028-UT

Acknowledgment is hereby made of the following addenda received since issuance of Plans and Specifications.

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

_____
(Name of Bidder)

_____
(Signature of Officer)

_____
(Title of Officer)

_____
(Date)

BIDDER'S PROPOSAL

PROJECT: East Water Reclamation Facility Screw Pump 22-0028-UT

_____

CONTRACTOR: _____

BIDDER'S GRAND TOTAL: $_____ (Numbers)

BIDDER'S GRAND TOTAL: _____

_____

_____ (Words)

	BID ITEMS	QTY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization/Demobilization and General Conditions (not to exceed 8% of the Base Bid)	1	LS		$ -
2	Screw Lift Station Upgrades	1	LS		$ -
3	Refurbishment of Slide Gates	1	LS		$ -
	Deductive Bid Alternate				
A.	Slide Gate Replacement	1	LS		$ -
6	Individual Bypass	1	LS		$ -
7	Omitting Concrete Repair of Effluent Channel	1	LS		$ -
8	All Other Work Required to Complete the Base Bid	1	LS		$ -
	SUBTOTAL				$ -
9	**10% CONTINGENCY**	1	LS		$ -
	TOTAL CONTRACT				$ -

THE BIDDER'S GRAND TOTAL ABOVE IS HIS TOTAL BID BASED ON HIS UNIT PRICES AND LUMP SUM PRICES AND THE ESTIMATED QUANTITIES REQUIRED FOR EACH SECTION. THIS FIGURE IS FOR INFORMATION ONLY AT THE TIME OF OPENING BIDS. THE CITY WILL MAKE THE TABULATION FROM THE UNIT PRICES AND LUMP SUM PRICE BID. IF THERE IS AN ERROR IN THE TOTAL BY THE BIDDER, IT SHALL BE CHANGED AS ONLY THE UNIT PRICES AND LUMP SUM PRICE SHALL GOVERN.

THE CONTRACTOR SHALL PROVIDE COPIES OF A CURRENT CONTRACTOR LICENSE/REGISTRATION WITH THE STATE OF FLORIDA AND PINELLAS COUNTY IN THE BID RESPONSE.

SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH CUBA AND SYRIA CERTIFICATION FORM

PER SECTION III, ITEM 25, IF YOUR BID IS $1,000,000 OR MORE, THIS FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID PROPOSAL. FAILURE TO SUBMIT THIS FORM AS REQUIRED, MAY DEEM YOUR SUBMITTAL NONRESPONSIVE.

The affiant, by virtue of the signature below, certifies that:

1. The vendor, company, individual, principal, subsidiary, affiliate, or owner is aware of the requirements of section 287.135, Florida Statutes, regarding companies on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or engaging in business operations in Cuba and Syria; and
2. The vendor, company, individual, principal, subsidiary, affiliate, or owner is eligible to participate in this solicitation and is not listed on either the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Sector List, or engaged in business operations in Cuba and Syria; and
3. Business Operations means, for purposes specifically related to Cuba or Syria, engaging in commerce in any form in Cuba or Syria, including, but not limited to, acquiring, developing, maintaining, owning, selling, possessing, leasing or operating equipment, facilities, personnel, products, services, personal property, real property, military equipment, or any other apparatus of business or commerce; and
4. If awarded the Contract (or Agreement), the vendor, company, individual, principal, subsidiary, affiliate, or owner will immediately notify the City of Clearwater in writing, no later than five (5) calendar days after any of its principals are placed on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Sector List, or engages in business operations in Cuba and Syria.

_____
Authorized Signature

_____
Printed Name

_____
Title

_____
Name of Entity/Corporation

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me on this _____ day of _____, 20____, by _____ (name of person whose signature is being notarized) as the _____ (title) of _____ (name of corporation/entity), personally known to me as described herein _____, or produced a _____ (type of identification) as identification, and who did/did not take an oath.

_____
Notary Public

_____
Printed Name

My Commission Expires: _____
NOTARY SEAL ABOVE

SCRUTINIZED COMPANIES THAT BOYCOTT ISRAEL LIST CERTIFICATION FORM

PER SECTION III, ITEM 25, THIS FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID PROPOSAL. FAILURE TO SUBMIT THIS FORM AS REQUIRED, MAY DEEM YOUR SUBMITTAL NONRESPONSIVE.

The affiant, by virtue of the signature below, certifies that:

1. The vendor, company, individual, principal, subsidiary, affiliate, or owner is aware of the requirements of section 287.135, Florida Statutes, regarding companies on the Scrutinized Companies that Boycott Israel List, or engaged in a boycott of Israel; and
2. The vendor, company, individual, principal, subsidiary, affiliate, or owner is eligible to participate in this solicitation and is not listed on the Scrutinized Companies that Boycott Israel List, or engaged in a boycott of Israel; and
3. "Boycott Israel" or "boycott of Israel" means refusing to deal, terminating business activities, or taking other actions to limit commercial relations with Israel, or persons or entities doing business in Israel or in Israeli-controlled territories, in a discriminatory manner. A statement by a company that it is participating in a boycott of Israel, or that it has initiated a boycott in response to a request for a boycott of Israel or in compliance with, or in furtherance of, calls for a boycott of Israel, may be considered as evidence that a company is participating in a boycott of Israel; and
4. If awarded the Contract (or Agreement), the vendor, company, individual, principal, subsidiary, affiliate, or owner will immediately notify the City of Clearwater in writing, no later than five (5) calendar days after any of its principals are placed on the Scrutinized Companies that Boycott Israel List, or engaged in a boycott of Israel.

_____
Authorized Signature

_____
Printed Name

_____
Title

_____
Name of Entity/Corporation

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me on this _____ day of _____, 20____, by _____ (name of person whose signature is being notarized) as the _____ (title) of _____ (name of corporation/entity), personally known to me as described herein _____, or produced a _____ (type of identification) as identification, and who did/did not take an oath.

_____
Notary Public

_____
Printed Name

My Commission Expires: _____
NOTARY SEAL ABOVE