

**SAN ANTONIO WATER COMPANY
UPLAND, CALIFORNIA**



CONTRACT DOCUMENTS

CAMPUS AVENUE PIPELINE PROJECT

LOCATED AT

**FROM: EAST 20th STREET
TO: EAST 23rd STREET**

UPLAND, CA

CO#1807-P

BID DATE

July 18, 2019, at 3:00 p.m.

CONTRACT DOCUMENTS SECTION

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**SECTION 1.1
Of
PROCEDURAL DOCUMENTS**

NOTICE INVITING BIDS

NOTICE IS HEREBY GIVEN that San Antonio Water Company, hereinafter referred to as the “Company”, on behalf of and as authorized by the Board of Directors of Company, will receive sealed bids for:

CAMPUS AVENUE PIPELINE PROJECT – From: East 20th Street, To: East 23rd Street, Upland, CA [CO#1807-P]

Bids will be received in the office of San Antonio Water Company up to the hour of 3:00 o'clock p.m. on **July 18, 2019** and then publicly opened and read aloud. Said bids will thereafter be referred to the Board of Directors for consideration.

Bids should be marked on the outside of the sealed envelope:

RE: Contract Documents and Specifications for *CAMPUS AVENUE PIPELINE PROJECT – From; East 20th Street, To: East 23rd Street, Upland, CA [CO#1807-P]*

Mailed or dropped off sealed bids may be delivered to:

San Antonio Water Company
139 North Euclid Avenue
Upland, California 91786

Owner reserves the right to reject any and all proposals, to waive any irregularity or to award the contract to other than the lowest responsible bidder. Bidder may not withdraw his/her bid for 30 days after the bid opening.

CONTRACT DOCUMENTS

Copies of the Contract documents may be examined and obtained at the office of San Antonio Water Company, 139 North Euclid Avenue, Upland, California 91786. Contract documents may be obtained upon a non-refundable payment of \$100.00 for each set.

PRE-BID MEETING

A pre-bid meeting / job walk for prospective bidders will be conducted on **June 27, 2019 at 10:00 a.m.** at the San Antonio Water Company Office at 139 North Euclid Avenue.

PLANS AND SPECIFICATIONS

All of the above work is to be done under Contract with the Company and in accordance with those certain plans specifications and drawings prepared by San Antonio Water Company, hereafter called the “Engineer”, and considered and approved by the Board of Directors of Company to which Documents reference is hereby made for a description of said works and improvements.

BONDS

The Contractor will be required to execute a Contract on the Company's standard form; furnish Contract Performance Bond (100% of contract amount) and Payment (Materials) Bond (50% of contract amount) with a corporate surety in conformance with the Contract Documents, or equivalent substitution in lieu of bonds, each for not less than the aforementioned amount of the total bid price; furnish certificates of insurance evidencing that all insurance coverage required by the Contract Documents has been secured.

PAYMENT

Company payments will be made by check to the Contractor in accordance with the provisions of the specifications and on itemized estimates duly certified and approved by the General Manager of the Company and Engineer submitted in accordance therewith, based on labor and materials incorporated into said works and improvements during the preceding month by the Contractor, less 10% withholding.

Payment shall not be made more often than once each thirty-(30) days. Final payment shall be made thirty-five (35) days subsequent to filing of Notice of Completion.

Contractor is advised that he/she may, at his/her sole cost and expense, substitute securities equivalent to any monies withheld by the Company to insure performance under the Contract. Such securities shall be deposited with a State or Federally Chartered Bank, located in Upland and as approved by the Company, as escrow agent who shall pay such monies to the Contractor upon satisfactory completion of the Contract. The Contractor shall be the beneficial owner of any securities substituted for monies withheld and shall receive any interest thereon. Securities eligible for investment under this section shall include those listed in Government Code Section 16430 or bank or savings and loan certificates of deposit.

BID SECURITY

All proposals or bids shall be accompanied by a cashier's or certified check payable to the order of Company, amounting to ten (10) percent of the bid or by a bond in said amount and payable to Company, signed by the Bidder and a corporate surety. Said check shall be forfeited or said bond shall become payable to Company in case the Bidder depositing the same does not, within ten (10) days after written notice, sign the Contract.

AWARD AND EXECUTION

The Award of Contract, if made, will be within thirty (30) calendar days from the date of the bid opening.

Bidders shall agree that the Bid shall be good and may not be withdrawn for a period of thirty (30) calendar days after the scheduled closing time for receiving Bids.

The Contractor shall execute the Contract within ten (10) working days after he has been notified in writing of the award.

The Company hereby reserves the right to reject any and all proposals, to waive any irregularity, and to award the Contract to the lowest responsive and responsible Bidder.

CONTRACTOR'S LICENSE CLASSIFICATION

The prime Contractor must possess the following California Contractor's License:

A – General Engineering Contractors license at the time of the scheduled bid opening of this Contract.

DATED: June 11, 2019

SAN ANTONIO WATER COMPANY
Brian Lee, General Manager



INSTRUCTIONS TO BIDDERS

Bids will be received by the San Antonio Water Company hereinafter called the “**Company**”, at 139 North Euclid Avenue, Upland, California 91786, until **3:00 p.m., July 18, 2019**

Each Bid proposal must be submitted along with supporting Documents and bid proposals guarantee, all signed in a sealed envelope, and addressed to the Company at the above referenced address. Each sealed envelope containing a Bid must be plainly marked on the outside as:

**Contract Documents and Specifications
for
CAMPUS AVENUE PIPELINE PROJECT
From: East 20th Street To: East 23th Street, Upland, CA
Project CO-#1807-P**

and the envelope should bear on the outside the name of the Bidder, his address and his license number. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope, labeled as shown in the advertisement for Bid, and addressed to:

San Antonio Water Company
139 North Euclid Avenue
Upland, California 91786

Bidders are advised that in selecting a Contractor, Company reserves the right to consider the financial responsibility and general competency of each Bidder, as well as his/her reputation within the industry. Company expects each Bidder to fully and truthfully disclose all information required of the Bidder by the Bidding Documents. Each Bidder must be properly licensed and must sign and submit with his/her Proposal, Bidding Schedule / Declaration, the Bidder's Statement of Experience and References, Financial Statement (if requested), Plan for Construction, Bidding sheets, list of manufacturers, License Number Statement and other Supporting Documents. All Bidders shall supply the names and addresses of major material Suppliers and subcontractors as set forth in the bid.

All bid proposals shall be opened and read at the time and place set forth in the Notice Inviting Bids herein. Bidders and/or their authorized representatives are invited to be present. The award, if made, will be made within ten (10) days of the opening. The Company's policy is to award to the lowest responsible Bidder who can comply with the projected delivery and/or completion schedules. The Company may make such investigations as he deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Company all such information and data for this purpose as the Company may request. The Company reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Company that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the work contemplated therein. The Company reserves the right to reject any and all bids, to waive any irregularity, minor defects, or to award the subject Contract to other than the lowest Bidder. Notice of Award shall be made to a successful Bidder in writing and mailed to the address as set forth on the signature page of the Bidding Documents.

All Bids must be made on the required Bid forms. All blank spaces for Bid prices must be filled in, in ink or typewritten, and the Bid form must be fully completed and executed when submitted. Only one copy of the Bid form is required.

In the event there is more than one bid item in a Bidding Schedule, the Bidder shall furnish a price for all bid items in the schedule, and failure to do so will render the Proposal informal and may cause its rejection. The Bidder shall state in figures, the unit pieces or the specific sums as the case may be, for which he proposes to supply the labor, materials, supplies or machinery, and completely perform the Contract. The total amount of each item bid, and the total amount of the bid shall be stated in words and figures.

If the unit price and total amount named by a Bidder for any items are not in agreement, the unit price alone will be considered, as representing the Bidders intention and the total will be corrected to conform thereto. Quantities set forth in the bidding sheet are estimates of the amount of materials and equipment to be furnished and the amount of work to be done and are given only as a basis for comparison of bids. Final payment shall be made for the actual final quantities of the items at the unit prices bid in the proposal.

Each Bidder shall complete the attached Bid Proposal and Supporting Documents including any addenda or bulletins issued before receipt of bids and public opening of same. Each blank of each page shall be completed in full. The completed forms shall be without interlineations, alterations, or erasures; however, Bidder may correct errors by striking or lining out mistakes, entering corrections immediately there above and initialing the strikeout.

Company may, at its discretion, reject any bid to which the Bidder has added conditions, limitations, provisions, or any interlineations or alterations. Unauthorized conditions, limitations, or provisions attached to the Proposal will render it non-responsive and may cause its rejection. The completed Proposal forms shall be without interlineation, alterations or erasures. Alternative proposals will not be considered unless specifically requested. **Oral, telephonic proposals or modifications will not be considered.** A person, firm, or corporation shall not be allowed to make or file, or to be interested in, more than one bid, except an alternative bid when specifically requested; provided however, a person, firm, or corporation who has submitted a sub-proposal to a Bidder submitting a Proposal, or who has quoted prices on material to such Bidders, is not thereby disqualified from submitting a sub-proposal or firm quoting prices to other Bidders submitting proposals, or from submitting a Proposal as a prime Contractor. Company may also, at its discretion, reject any bid for which the Bidder has failed to supply all requested information or has misrepresented any of same information. Company will not consider alternative proposals unless they are called for by these instructions or the supplemental proposals on forms other than those bound herein, and those forms shall not be removed from the bound volume.

Separate copies of Bidder's Proposal with Supporting Documents are available for Bidder's use. Bidder shall retain said copies for his/her record. They shall not be submitted as a proposal.

Company will not consider any proposal, which is not complete.

Should a Bidder find discrepancies in, or omissions from the Special Provisions, General Provisions, Drawings, or other Documents bound herein, or should he/she be in doubt as to their meaning, he/she should immediately notify the Company who may send a written clarification to all Bidders.

If the Bid Proposal is made by an individual, it shall be signed and his/her full name and address shall be given; if it is made by a co-partnership, it shall be signed with the co-partnership name by one of the partners, who shall sign his/her own name and, in addition, the name and address of each partner shall be given; if it is made by a corporation, the name of the corporation shall be signed by its duly authorized officer, or officers, attested by the corporation seal, and the names and titles of all current officers of the corporation shall be given.

Any bid may be withdrawn prior to the above scheduled time for the opening of Bids or authorized postponement thereof. The Bidder by means of a written request, signed by the Bidder or their properly authorized representative may withdraw the Proposal. Such written request must be delivered to the place stipulated in the Notice Inviting Bids for receipt of proposals prior to the scheduled closing time for receipt of proposals. No Proposal may be withdrawn after the hour fixed for opening bids without making the accompanying certified or cashier's check, or Bidder's bond, subject to forfeiture as liquidated damages in like manner as in the case of failure to execute the Contract of furnish required bonds as hereinafter provided. Any bid received after the time and date specified shall not be considered. No Bidder may withdraw a Bid within sixty (10) days after the actual date of the opening thereof. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the Company and the Bidder.

Bidders must satisfy themselves of the character of the work to be performed by examination of the site and review of the Drawings and Specifications, including Addenda. Each Bidder is responsible for inspecting the site and for reading and being thoroughly familiar with the Contract Documents. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation in respect to his Bid. After bids have been submitted, the Bidder shall not assert that there was a misunderstanding concerning the nature of the work to be done.

The Company shall provide to Bidders, prior to Bidding, all information, which is pertinent to, and delineates and describes, the land owned, and rights-of-way acquired or to be acquired.

The Contract Documents contain the provisions required for the construction of the Project. Information obtained from an officer, agent, or employee of the Company or any other person shall not affect the risks or obligations assumed by the Contractor or relieve him from fulfilling any of the conditions of the Contract.

Each Bid must be accompanied by a Bid Bond (on the required form) payable to the Company for ten (10) percent of the total amount of the bid. Each bid proposal shall be accompanied by a certified or cashier's check or bid bond (bid bond shall be submitted on the form attached herein), or equivalent substitution of sureties for an amount of not less than 10 percent of the total bid amount named in the Bidding Sheet. Said check, bond or substitute shall be made payable to the Company and shall be given as a guarantee that the Bidder will enter into the Contract described in the Notice Inviting Bids herein if awarded the work. By submitting a proposal, each Bidder agrees that the Company may retain the bid proposal guarantee as liquidated damages if the Bidder is awarded the work but fails to or refuses to timely enter the Contract except as may otherwise be required by California Government Code Sections 37933-37935. As soon as the Bid prices have been compared, the Company will return the Bonds of all except the three lowest responsive and responsible Bidders. When the Agreement is executed, the bonds of the two remaining unsuccessful Bidders will be retained until all Contract Documents have been executed and approved, after which it will be returned.

Bonds and Insurance Certificates must be in the form required by the Company (substitutions are not permitted) and the Company must be authorized to do business in the State of California. Surety Companies executing bonds must possess a certificate of authority from the California Insurance Commissioner authorizing them to write surety insurance defined in Section 105 of the California Insurance Code. Surety Companies executing bond must also appear on the "Treasury List" of companies holding a Certificate of Authority as acceptable surety on Federal Bonds and possess an underwriting authority limitation exceeding the contract amount.

The successful Bidder shall, upon receipt of Notice of Acceptance of his/her bid, promptly secure with a responsible corporate surety or sureties approved by the Company, a Payment Bond and a Contract Performance Bond (on the required form), each in the amount of one hundred (100) percent of the Contract Price, will be required for the faithful performance of the Contract. Contractor may, upon written request, and at his sole expense after approval by the Board of Directors, deposit substitute securities referenced in Government Code Section 16430, or bank or savings and loan certificates of deposit, as authorized by Public Contract Code Section 22300 in lieu of retention monies withheld to ensure performance.

Attorneys-in-fact who sign Bid Bonds or Labor and Material Payment Bonds and Contract Performance Bonds must file with each Bond a certified and effective dated copy of the Power of Attorney.

The party to whom the Contract is to be awarded will be required to execute the Agreement and submit the Payment Bond, Contract Performance Bond and Insurance Certificates on the required forms within ten (10) calendar days from the date when the necessary Contract Agreement, Bonds, and Insurance Certificate forms and Notice of Award are delivered to lowest responsive Bidder. A corporation to which an award is made will be required, before the Contract is finally executed, to furnish evidence of its corporate existence and of the authority of the officer signing the Contract and bond for the corporation to so sign. In case of failure of the Bidder to execute the Agreement, the Company may, at its option, consider the Bidder in default; in which case the Bid bond accompanying the proposal shall become the property of the Company.

The Company, within ten (10) days of receipt of acceptable Labor and Material Payment bond, Contract Performance Bond, Insurance Certificate & Special Endorsement, and Agreement signed by the party to whom the Agreement was awarded, shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the Company not execute the Agreement within such period, the Bidder may, by Written Notice, withdraw his signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the Company.

A Notice to Proceed will be issued by the Company as a part of this Contract within ten (10) days of the execution of the agreement by the Company. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement between the Company and Contractor. If the Notice to Proceed has not been issued within the above-specified period or within the period mutually agreed upon, the Contractor may terminate the Agreement without further liability on the part of either party.

The Company may make such investigations as he deems necessary to determine the ability of the Bidder to perform the Work, and the Bidder shall furnish to the Company all such information and data for this purpose as the Company may request. The Company reserves the

right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Company that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the Work contemplated therein.

The Company reserves the right to reject all bids.

Award, if made, will be made to the lowest responsive and responsible Bidder, as determined by the Company.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout. The Bidder's attention is directed to the Standard Specifications for Public Works construction and modifications of the Special Provisions bound herein for additional requirements of the Proposal and Contract Documents.

Each Bidder is responsible for inspecting the site and for reading and being thoroughly familiar with the Contract Documents. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation in respect to his Bid.

All work shall be completed within **One Hundred Twenty (120) calendar days** from Notice to Proceed.

ADDITIONAL INSTRUCTIONS TO BIDDERS

DEFINED TERMS. Terms used in these Instructions to Bidders and the Notice Inviting Bids which are defined in the General Conditions have the meanings assigned to them in the General Conditions. The term "Bidder" means one who submits a Bid directly to OWNER, as distinct from a sub-bidder, who submits a price or quote to a Bidder

LOCAL BUSINESS LICENSE. ALL CONTRACTORS, including Subcontractors not already having a local business license for the work contemplated, will be required to secure the appropriate license before a Contract can be executed.

3. INTERPRETATIONS AND ADDENDA.

A. All questions about the meaning or intent of the Contract Documents are to be directed to the PROJECT ENGINEER in writing. Additions, deletions or revisions to the Contract Documents considered necessary by the PROJECT ENGINEER in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by the PROJECT ENGINEER or OWNER as having received the Contract Documents. Questions received less than 10 days prior to the date of Bids may not be answered. Only answers to such questions issued by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

B. Addenda may also be issued to make other additions, deletions or revisions to the Contract Documents.

C. Bidders shall make no special interpretation or inference of intent from differing formats in the Technical Specifications.

4. BIDDER'S EXAMINATION OF CONTRACT DOCUMENTS AND SITE.

A. It is the responsibility of each Bidder before submitting a Bid:

1. To examine thoroughly the Contract Documents and other related data identified in the Bidding Documents (including "technical" data referred to below);

2. To visit the site to become familiar with local conditions that may affect cost, progress, or performance, of the WORK;

3. To consider federal, state and local Laws and Regulations that may affect cost, progress or performance, of the WORK.

4. To study and carefully correlate the Bidder's observations with the Contract Documents;
and

5. To notify the PROJECT ENGINEER of all conflicts, errors, ambiguities, or discrepancies in or between the Contract Documents and such other related data.

B. Reference is made to the Supplementary General Conditions for identification of:

1. Those reports of explorations and tests of subsurface conditions at the site which have been utilized by the PROJECT ENGINEER in the preparation of the Contract Documents.

Those drawings or videotapes of physical conditions in or relating to existing surface and subsurface conditions (except Underground Utilities) which are at or contiguous to the site have been utilized by the PROJECT ENGINEER in the preparation of the Contract Documents.

The PROJECT ENGINEER makes no representation as to the completeness of the reports or drawings referred to in Paragraphs 4.B.1 and 4.B.2 or the accuracy of any data or information contained therein. The Bidder may rely upon the accuracy of the technical data contained in such reports and drawings. However, the Bidder may not rely upon any interpretations of such technical data, including any interpretation or extrapolation thereof, or any non-technical data, interpretations and opinions contained therein.

C. Copies of reports and drawings referred to in Paragraph 4.B will be made available by the OWNER to any Bidder upon request, if said reports and drawings are not bound herein. Those reports and drawings are not part of the Contract Documents.

D. Information and data reflected in the Contract Documents with respect to Underground Utilities at or contiguous to the site are based upon information and data furnished to the OWNER and PROJECT ENGINEER by the owners of such Underground Utilities or others, and the OWNER does not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Supplementary General Conditions or Section 01530 – Protection of Existing Facilities.

E. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, Underground Utilities and other physical conditions, and possible changes in the Contract Documents due to differing conditions appear in Paragraphs 5.1 and 5.3 of the General Conditions.

F. Before submitting a Bid, each Bidder will, 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 Utilities) at or contiguous to the site or otherwise which may affect cost, progress or performance of the WORK and which the Bidder deems necessary to determine its Bid for performing the WORK in accordance with the time, price and other terms and conditions of the Contract Documents.

G. On request a minimum of 2 days in advance, the OWNER will provide each Bidder access to the site to conduct such examinations, investigations, explorations, tests, and studies as each Bidder deems necessary for submission of a Bid. Location of any excavation or boring shall be subject to prior approval of OWNER and applicable agencies. Bidder shall fill all holes, restore all pavement to match existing structural section, and shall clean up and restore the site to its former condition upon completion of such explorations. OWNER reserves the right to require Bidder to execute an Access Agreement with the OWNER prior to accessing the site.

H. 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 area 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 OWNER unless otherwise provided in the Contract Documents.

The submission of a Bid will constitute an incontrovertible representation by the Bidder that the Bidder has complied with every requirement of this Paragraph 4 and the following:

1. That the Bid is premised upon performing the WORK required by the Contract Documents without exception and such means, methods, techniques, sequences or procedures of construction (if any) as may be required by the Contract Documents;

2. That Bidder has given the PROJECT ENGINEER written notice of all conflicts, errors, ambiguities, and discrepancies in the Contract Documents and the written resolution thereof by the PROJECT ENGINEER is acceptable to the Bidder; and

3. That the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the WORK.

5. BID FORMS. The Bid shall be submitted on the Bid Forms bound herein. All blanks on the Bid Forms shall be completed in ink. All names must be printed below the signatures. The Bid shall be submitted in a sealed envelope which shall be plainly marked in the upper left hand corner with the name and address of the Bidder and shall bear the words "BID FOR" followed by the title of the Contract Documents for the WORK, the name of the OWNER, the address where Bids are to be delivered or mailed, and the date and hour of opening of Bids.

6. CERTIFICATES.

A. Bids by corporations must be executed in the corporate name by the president, a vice-president, or other corporate officer. Such Bid shall be accompanied by the enclosed Certificate of Authority to sign, attested by the secretary or assistant secretary, and with the corporate seal. The corporate address and state of incorporation must appear below the signature.

B. Bids by partnerships must be executed in the partnership name and be signed by a managing partner, accompanied by the enclosed Certificate of Authority to sign, and his/her title must appear under the signature and the official address of the partnership must appear below the signature.

C. Bids by joint ventures must be executed in the joint venture name and be signed by a joint venture managing partner, accompanied by the enclosed Certificate of Authority to sign, and his/her title must appear under the signature and the official address of the joint venture must appear below the signature.

7. DISQUALIFICATION OF BIDDERS. More than one Bid from an individual, firm, partnership, corporation or association under the same or different names will not be considered. If the OWNER believes that any Bidder is interested in more than one Bid for the WORK contemplated, all Bids in which such Bidder is interested will be rejected. If the OWNER believes that collusion exists among the Bidders, all Bids will be rejected. A party who has quoted prices to a Bidder is not hereby disqualified from quoting prices to other Bidders, or from submitting a Bid directly for the WORK.

8. QUANTITIES OF WORK. The quantities of work or material stated in unit price items of the Bid are supplied only to give an indication of the general scope of the WORK; the OWNER does not expressly or by implication agree that the actual amount of work or material will correspond therewith and reserves the right after award to increase or decrease the quantity of any unit price item of the WORK by an amount up to and including 25 percent of any Bid item, without a change in the unit price, and shall include the right to delete any Bid item in its entirety or to add additional Bid items up to and including an aggregate total amount not to exceed 25 percent of the Bid price.

SUBSTITUTE OR "OR EQUAL" ITEMS. Whenever materials or equipment re specified or described in the Contract Documents by using the name of a particular Supplier and the name is followed by the word

“or equal,” the Bidder may write the name of a substitute Supplier (which the Bidder considers as an “or equal”) in the Proposed Substitute Equipment/Material Supplier List in the Bid Forms. These substitute Suppliers will only be considered after award of the Contract. The bidder shall have 35 days after the award of the contract for submission of data substantiating a request for a substitution, as set forth in the Public Contract Code, Section 3400. The procedure for the submittal of substitute or “or equal” products is specified in Section 01600 – Products, Materials, Equipment, and Substitutions. The Bidder shall not be relieved of any obligations of the Contract Documents or be entitled to an adjustment in the Contract Price in the event any proposed substitute supplier is not subsequently approved.

10. COMPETENCY OF BIDDERS. In selecting the lowest responsive, responsible Bidder, consideration will be given not only to the financial standing but also to the general competency of the Bidder for the performance of the WORK covered by the Bid. To this end, each Bid shall be supported by a statement of the Bidder’s experience as of recent date on the form entitled “INFORMATION REQUIRED OF BIDDER” bound herein.

11. SUBMISSION OF BIDS. The Bid shall be delivered by the time and to the place stipulated in the Notice Inviting Bids. It is the Bidder’s sole responsibility to see that its Bid is received in proper time and at the proper place.

12. BID SECURITY, BONDS, AND INSURANCE. Each Bid shall be accompanied by cash, a certified or cashier’s check or approved Bid Bond in the amount stated in the Notice Inviting Bids. Said check or bond shall be made payable to the OWNER and shall be given as a guarantee that the Bidder, if awarded the WORK, will enter into an Agreement with the OWNER, and will furnish the necessary insurance certificates, Payment Bond, and Performance Bond; each of said bonds to be in the amount stated in the Supplementary General Conditions. In case of refusal or failure to enter into said Agreement, the check or Bid Bond, as the case may be, shall be forfeited to the OWNER. If the Bidder elects to furnish a Bid Bond as its Bid security, The Bidder shall use the Bid Bond form bound herein, or one conforming substantially to it in form. Bid Bonds shall comply with the requirements applicable to payment and performance bonds in the General Conditions.

13. DISCREPANCIES IN BIDS. In the event there is more than one Bid item in a Bid Schedule, the Bidder shall furnish a price for all Bid items in the Schedule, and failure to do so will render the Bid non-responsive and shall cause its rejection. In the event there are unit price Bid items in a Bidding schedule and the amount indicated for the unit price Bid item does not equal the product of the unit price and quantity, the unit price shall govern, and the amount will be corrected accordingly, and the BIDDER shall be bound by said correction. In the event there is more than one Bid item in a Bid Schedule and the total indicated for the Schedule does not agree with the sum of the prices Bid on the individual items, the prices Bid on the individual items shall govern and the total for the Schedule will be corrected accordingly, and the BIDDER shall be bound by said corrections.

14. MODIFICATIONS AND UNAUTHORIZED ALTERNATIVE BIDS. Unauthorized conditions, limitations or provisos attached to the Bid shall render it informal and may cause its rejection as being non-responsive. The Bid forms shall be completed without interlineations, alterations, or erasures in the printed text. Alternative Bids will not be considered unless called for. Oral, telegraphic or telephonic Bids or modifications will not be considered.

WITHDRAWAL OF BID. The Bid may be withdrawn by the Bidder by means of a written request, signed by the Bidder or its properly authorized representative. Such written request must be delivered to the place stipulated in the Notice Inviting Bids for receipt of Bids prior to the scheduled closing time for receipt of Bids.

16. AWARD OF CONTRACT. Award of the contract, if awarded, will be made to the lowest responsive, responsible Bidder whose Bid complies with the requirements of the Contract Documents. Unless otherwise specified, any such award will be made within the period stated in the Notice Inviting Bids that the bids are to remain open. Unless otherwise indicated, a single award will be made for all the Bid items in an individual Bid Schedule. In the event the WORK is contained in more than one Bid Schedule, the OWNER may award Schedules individually or in combination. In the case of two Bid Schedules which are alternative to each other, only one of such alternative schedules will be awarded.

17. RETURN OF BID SECURITY. Within 14 days after award of the contract, the OWNER will, if requested, return the Bid securities accompanying such Bids that are not being considered in making the award. All other Bid securities will be held until the Agreement has been finally executed. They will then be returned, if requested, to the respective Bidders whose Bids they accompany, within 60 days of the award.

18. EXECUTION OF AGREEMENT. The Bidder to whom award is made shall execute a written Agreement with the OWNER on the form of agreement provided, shall secure all insurance, and shall furnish all certificates and bonds required by the Contract Documents within 10 calendar days after receipt of the agreement forms from the OWNER. Failure or refusal to enter into an Agreement as herein provided or to conform to any of the stipulated requirements in connection therewith shall be just cause for annulment of the award and forfeiture of the Bid security. If the lowest responsive, responsible Bidder refuses or fails to execute the Agreement, the OWNER may award the Contract to the second lowest responsive, responsible Bidder. If the second lowest responsive, responsible Bidder refuses or fails to execute the Agreement, the OWNER may award the contract to the third lowest responsive, responsible Bidder. On the failure or refusal of such second or third lowest Bidder to execute the Agreement, each such Bidder's Bid securities shall be likewise forfeited to the OWNER.

19. LIQUIDATED DAMAGES. The fixed liquidated damages amount is hereby established as Eight Hundred Dollars (\$800.00) for each calendar day of unauthorized delay in completion of the Work beyond 180 calendar days as set forth in the Notice Inviting Bids. This figure was calculated based upon a reasonable estimation of prospective damages for this particular project.

20. WORKERS' COMPENSATION REQUIREMENT. The Bidder should be aware that in accordance with Section 3700 of the California Labor Code it will, if awarded the Contract, be required to secure the payment of compensation to its employees and execute the Workers' Compensation Certification in the form contained in these Contract Documents.

21. DESIGNATION OF SUBCONTRACTORS. Pursuant to state law, each bidder must designate the name and location of each subcontractor who will perform work or render services for the prime Bidder in an amount that exceeds one-half of one percent (0.5%) of the Bidder's Total Bid Price, as well as the portion of work each such subcontractor will perform. Bidders must make these designations on the document titled "List of Subcontractors" which has been included with the Bid Forms (Document 00300).
FILING OF BID PROTESTS. Bidders may file a "protest" of a contract award with the Owner. In order for a Bidder's protest to be considered valid, the protest must:

- Be filed timely and in writing within five (5) Calendar Days after the bid opening date.
- Clearly identify the specific accusation involved.
- Clearly identify the specific Owner Staff/Board recommendation being protested.

- Specify, in detail, the grounds of the protest and the facts supporting the protest.
- Include all relevant, supporting documentation with the protest at time of filing.

If the protest does not comply with each and every one of these requirements, it will be rejected as invalid. If the protest is valid the Owner shall review the basis of the protest and all relevant information. The Owner will deny or concur with the protest and provide a written decision to the protestor. The protestor may then appeal the decision to the Owners' Board of Directors.

23. OWNER'S RIGHTS. The owner may investigate the qualifications of any Bidder under consideration, require confirmation of information furnished by the Bidder, and require additional evidence of qualifications to perform the work described in these Bid Documents. The Owner reserves the right to:

- Reject any or all of the Bids if such action is in the best interest of the Owner.
- Issue subsequent Notices Inviting Bids.
- Cancel this entire Notice Inviting Bids.
- Appoint evaluation committees to review any or all Bids.
- Seek the assistance of outside technical experts to validate the Bid(s).
- Approve or disapprove the use of particular subcontractors.
- Waive informalities and irregularities in Bids.

The Notice Inviting Bids does not commit the Owner to enter into a contract, nor does it obligate the Owner to pay any costs incurred in preparation and submission of Bids or in anticipation of a contract.

24. BIDDER'S RESPONSIVENESS. The Owner will evaluate Bids for responsiveness at the time of Bid opening and before award is made. A Bid must be in strict compliance with the commercial and technical specifications, without exception. Only Bids which conform in all material respects to the Bid Documents can be eligible for award. A Bid not meeting the requirements of the responsiveness checklist may be rejected immediately upon opening and returned to the Bidder's representative.

25. RESPONSIBILITY CRITERIA. Responsibility is the apparent ability of the bidder to meet and complete successfully the requirements of the Contract. The Owner reserves the right to consider the financial responsibility and general competency of each Bidder, as well as its reputation within the industry. Owner may request, and apparent low bidder shall provide, a financial statement, audited if necessary, including the Bidder's latest balance sheet and income statement. Owner expects that each Bidder will fully and truthfully disclose all information required of the Bidder by the Bid Documents. The prospective contractor, in order to be evaluated by the Owner as being a responsible contract, must complete the Bid Form to determine that it:

- Has or can secure adequate financial resources to perform the contract;
Is able to meet the performance or delivery schedule of the contract, taking into consideration other business commitments; and
- Has a satisfactory record of performance. A contractor seriously deficient in current contract performance, considering the number of contracts and extent of the deficiencies, is presumed not to meet this requirement unless the deficiencies are beyond its control or there is evidence to establish its responsibility notwithstanding the deficiencies. Evidence of such satisfactory performance record should show that the contractor: (1) has a satisfactory record of integrity in its dealings with government agencies and with applicable laws and regulations; (2) has the necessary organization, experience, satisfactory safety record, accounting and operational

controls and technical skills or the ability to obtain them; and (3) has the necessary production, construction and technical equipment and facilities or the ability to obtain them.

– END OF INSTRUCTIONS TO BIDDERS

CONTRACTOR'S PROPOSAL

BID PROPOSAL WITH SUPPORTING DOCUMENTS FOR

CAMPUS AVENUE PIPELINE PROJECT

CO#1807-P

Located from: East 20th Street to: East 23th Street, Upland, CA

FROM:

NAME OF BIDDER: _____

BUSINESS ADDRESS: _____

TELEPHONE NO: _____

TO:

**BOARD OF DIRECTORS
SAN ANTONIO WATER COMPANY**

BOARD:

Pursuant to your invitation to provide Sealed Bids for the "Campus Avenue Pipeline Project from: E. 20nd Street to: E. 23th Street in Upland, CA", the undersigned hereby declares that the only persons interested in this Proposal as principals are those named herein, that the Bidder has no connection with any other parties bidding on this project (except for a corporate division of the undersigned which may submit an independent bid), and that this bid has been prepared and submitted independently, without consultation, communication, or agreement with any other Bidder or competitor, without any collusion, fraud, misrepresentation, or deceit.

In submitting this Proposal, the undersigned further declares that he/she has read the Notice Inviting Bids, the Instruction to Bidders, the unexecuted Contract, and all other Documents incorporated by reference, including the Special Provisions, the Basic Specifications, Modifications thereto, and the Construction Plans and Standard Drawings and that he/she has inspected the work site and hereby proposes to furnish all materials, machinery, tools, labor and services, and do all the work necessary to complete the Project in accordance with said plans, specifications and provisions at the below stated item prices.

In exchange for consideration of this Proposal by the Company, the Bidder agrees that if his/her bid is accepted by the Company, the Bidder will execute said Contract, furnish and provide the items set forth in this Proposal and required by the Contract, the Standard Specifications for Public Works Construction, the Special Provisions and Specifications, and the Construction Plans and Standard Drawings (**One Hundred and Twenty (120) calendar days**), and will accept as full payment the prices set forth in the Bidding Sheet.

The undersigned further agrees that he/she shall execute such Contract within ten days from the date of mailing to him of written notice of the Company's acceptance of this proposal and within the same time shall furnish bond(s), along with the required certificates of insurance, and

that upon failure to do so within said time, the proposal guaranty shall become the property of the Company as liquidated damages for such failure or refusal, and shall be deposited as moneys belonging to the Company; provided that if said Bidder shall execute the Contract and furnish the required bonds and certificates of insurance within the time aforesaid, his/her proposal guaranty shall be returned to him within ten days thereafter.

Bidder agrees with the Company that if the project is not fully completed within said time, he will pay as liquidated damages, the sum of \$800 for each consecutive calendar day thereafter as provided in Section 6-9 of the Standard Specifications, and that this amount shall be presumed to be the amount of damages sustained by Company in the event of such a breach by Bidder, as it would be impracticable or extremely difficult to fix the actual damage.

BY: _____

TITLE: _____

**PROPOSAL
BIDDING SCHEDULING / DECLARATION**

The undersigned agrees that all of the work included in the Proposal shall be completed in **One Hundred and Twenty (120) calendar days** as provided in the Contract Plans and Specifications. The undersigned further agrees that in case of default in executing the required Contract with necessary bonds within ten (10) working days, from the date of mailing of a notice from the Company that the Contract has been awarded, the proceeds of the check or bond accompanying his bid shall become the property of San Antonio Water Company.

Licensed in accordance with an Act providing for the registration of Contractors.

LICENSE NUMBER: _____

CONTRACTOR: _____

BY: _____

TITLE: _____

BUSINESS ADDRESS:

If an individual, so state. If a firm is co-partnership, state the firm name, and give the names and addresses of all individuals, co-partners, composing the firm. If a corporation, state the legal name of corporation; also, the names of President, Secretary, manager, and Treasurer thereof, with their business addresses:

Corporate chartered under the laws of the State of: _____

BID SCHEDULE

**BASE BID SCHEDULE
FOR
Campus Avenue- PIPELINE PROJECT
CO#1807-P**

Item #	DESCRIPTION	QUANTITY & UNIT	UNIT PRICE	AMOUNT
1	Mobilization/Demobilization 50% at Mobilization and 50% at Demobilization	1 L.S.		
2	Traffic Control Plans, Trenching and Shoring, Safety Measures, Permits, and message board.	1 L.S.		
3	Furnish and Install 8-inch PVC Pipe, class C-900, including: pipe, bends, fittings, couplings, etc.	2,900 L.F.		
4	Furnish and install 8-inch Gate Valve, including: valve can and cover, fittings, couplings, etc.	2 EA.		
5	Furnish and install 4-inch PVC Pipe, class C-900, including: pipe, bends, fittings, couplings, etc.	410 L.F.		
6	Furnish and Install 4-inch gate valve, including: valve, valve can and cover, couplings, fittings, gaskets, etc.	1 EA.		
7	Saw cut, remove and replace concrete cross gutter and driveway approach, etc.	90 S.F.		
8	Construct temporary A.C. pavement, including saw cut and removal of old a.c. pavement	2,000 L.F..		
9	Construct 48 (Max.) inch wide x 4-inch thick A.C. Base pavement over compacted native material	2,000 L.F.		

10	Construct 96-inch-wide x 1-inch thick A.C. Finish pavement over compacted A.C. Base Pavement	2,000 L.F.		
11	Remove and replace existing fencing	1 LS		
12	Pressure Test and flush new water lines	1 LS		
13	Type 2 Slurry Seal	54,000 SF		

Total Bid Schedule (Items 1 thru 13) = \$ _____

(IN WORDS) _____

Bidder hereby acknowledges that all bid prices include any amounts payable by Owner for taxes which may result from this proposal

CONTRACTOR: _____

BY: _____

TITLE: _____

BIDDING SHEET

In the blanks provided, fill in the prices at which you propose to furnish the scheduled construction, including all labor, materials, equipment, work and methods necessary to complete the work, and all applicable sales and use taxes imposed pursuant to the laws of the State of California.

Bidders are advised that they must include a proportional amount of overhead, profit, sales tax and all other applicable taxes and fees, etc., within the bid prices for each bid item, since the amount of bid under which award will be made, if made, will be determined by the Company after the bids have been received.

Quantities set forth in the Bidding Sheet are estimates of the amount of materials and equipment to be furnished and the amount of work to be done and are given only as a basis for comparison of bids. Final payment shall be made for the actual final quantities of the items at the unit prices bid in the proposal

All Bidders must bid on all Item No.'s.

ADDENDA

Bidder acknowledges receipt of the following Addenda:

_____ DATED _____
_____ DATED _____
_____ DATED _____

The Company's policy is to award to the lowest responsive and responsible Bidder.

However, Bidders are advised that Company reserves the right not to make an award. Bidder agrees to perform all the work described in the Contract Documents for the following unit prices or lump sum:

BIDDER'S STATEMENT OF EXPERIENCE AND REFERENCES

Names and addresses of all members of co-partnership or names and titles of all officers of the corporation:

The bidder declares that the surety (sureties) named in the space provided below have agreed to furnish bonds in the amounts set forth in the Instruction to the Bidders, in the event the Contract is awarded on the basis of this proposal.

Names and addresses of surety or sureties agreeing to furnish bond:

Each Bidder (Contractor) is required to furnish work record for Sub-bidders (Subcontractors). List at least two projects each that the Sub-bidders have completed within the past three- (3) years. Responses must be full and explicit. Use reverse side or additional sheets as necessary. The Sub-bidder's name should correspond to the names of Subcontractors shown on the following page of Subcontractor performing in excess of one-half of one percent of the total bid price.

PROJECT NAME: _____

DESCRIPTION: _____

CONTRACT AMOUNT: \$ _____ DATE COMPLETED: _____

OWNER'S NAME: _____

ADDRESS: _____

TELEPHONE NO: () _____

PROJECT NAME: _____

DESCRIPTION: _____

CONTRACT AMOUNT: \$ _____ DATE COMPLETED: _____

OWNER'S NAME: _____

ADDRESS: _____

TELEPHONE NO: () _____

PROJECT NAME: _____

DESCRIPTION: _____

CONTRACT AMOUNT: \$ _____ DATE COMPLETED: _____

OWNER'S NAME: _____

ADDRESS: _____

TELEPHONE NO: () _____

FINANCIAL STATEMENT

If requested by the Company, the bidder shall furnish a notarized financial statement, references, and other information, sufficiently comprehensive to permit an appraisal of his current financial condition.

SUBCONTRACTORS

List the name and address of **all subcontractors** who will perform work in or about the work or improvement in excess of one-half of one percent of the total bid price and indicate what part of the work will be done by each such Contractor. (Submit additional sheets if required.) Only one sub-bidder shall be listed for each portion of work.

If the Contractor fails to specify a subcontractor for any portion of the work in excess of one-half (1/2) of one (1) percent of the total Bid to be performed under the Contract, he shall be deemed to have agreed to perform such portion himself and he shall not be permitted to subcontract that portion of the work except under conditions permitted by law.

Subletting or subcontracting of any portion of the work as to which no subcontractor was designated in the original Bid shall only be permitted in case of public emergency or necessity, or otherwise permitted by law, and then only after a finding reduced to writing as a public record of the Company.

Item No. of Work	Name of Firm/Contractor	Location of Mill/shop/office	% of Item to be Performed by Subcontractor

Has Bidder, as Contractor, been involved in litigation with any owner of any project within the last ten- (10) years? If so, please describe the projects(s) and the nature and results of any litigation including any lawsuits settled prior to trial.

Has any sub-bidder, as contractor, been involved in litigation with any owner of any project within the last ten (10) years? If so, please describe the project(s) and the nature and results of any litigation including any lawsuits settled prior to trial.

List the name of the person who examined the work site of the proposed work for your firm:

Date of Inspection: _____

LISTING OF MANUFACTURERS

The contractor shall submit this sheet with his bid, completed, to list the manufacturers of materials he intends to use. It shall be understood that where the contractor elects to not use the material manufacturers called for in the Specifications he will substitute only items of equal quality, durability, functional character and efficiency as determined by the Engineer. The contractor should ascertain prior to bidding the acceptability of substitutes. Only one manufacturer shall be listed for each item.

ITEM OR MATERIAL	MANUFACTURER ADDRESS AND PHONE NUMBER	SUPPLIER ADDRESS AND PHONE NUMBER
8" PVC Pipe C900		
8" Gate Valves		
4" PVC Pipe C900		
4" Gate Valve		
A.C. Pavement		

No change shall be allowed of any material manufacturer listed after receipt of Bids unless the manufacturer so listed cannot furnish materials meeting the Specifications. Should such change be allowed, there will be no increase in the amount of the bid originally submitted.

In submitting a Bid to a purchasing body, the Bidder offers and agrees that if the Bid is accepted, it will assign to the purchasing body all rights, title and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Chapter 2 of Part 2 of Division 7 of the business and Professions Code) arising from purchases of goods, materials, or services by the Bidder for sale to the purchasing body pursuant to the bid. Such assignment shall be made and become effective at the time the purchasing body tender's final payment to the Bidder.

RESPECTFULLY SUBMITTED:

SIGNATURE

TITLE

DATE

ADDRESS

TELEPHONE NUMBER

CITY, STATE, ZIP

CONTRACTOR'S LICENSE NO.

TYPE OF LICENSE AND CLASS

FEDERAL IDENTIFICATION NO.

SEAL (IF BID IS BY A CORPORATION)

ATTEST

**CERTIFICATION
LABOR CODE - SECTION 1861**

I, the undersigned Contractor, am aware of the provisions of Section 3700 ET. Seq. of the Labor Code which requires every employer to be insured against liability for Worker's Compensation or to undertake self-insurance in accordance with the provisions of that Code, and I, the undersigned Contractor, agree to and will comply with such provisions before commencing the performance of the work of this Contract.

CONTRACTOR:

FIRM NAME

BY: _____

BY: _____

SECOND PARTY

NON-COLLUSION AFFIDAVIT

STATE OF CALIFORNIA)

) SS.

COUNTY OF _____)

_____, being first duly sworn, deposes and
(NAME OF AFFIANT)

and says that he/she is _____
(TITLE)

of _____, the part making the foregoing bid; that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, Company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the Bidder has not directly or indirectly induced or solicited any other Bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any Bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the Bidder or any other Bidder, or to fix any overhead, profit or cost element of the bid price, or of that of any other Bidder, or to secure any advantage against the public body awarding the Contract of anyone interested in the proposed Contract; that all statements contained in the bid are true; and, further, that the Bidder has not directly or indirectly, submitted his/her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, Company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

(SIGNATURE)

(TYPED NAME))

SUBSCRIBED BEFORE ME on this _____ day of _____, 2019_____.

(NOTARY PUBLIC)

My Commission Expires: _____

CONTRACTOR'S LICENSING STATEMENT

I, the undersigned Contractor, am aware of State Business and Professions Code, Section 7028.15 which requires that the information shown below shall be included in the bid. Any bid not containing this information, or if this information is subsequently proven to be false shall be considered non-responsive and shall be rejected.

NAME OF CONTRACTOR: _____

BUSINESS ADDRESS: _____

Corporation organized
under the laws of the State of: _____

STATE LICENSE NO. _____

STATE LICENSE CLASSIFICATION _____

STATE LICENSE EXPIRATION DATE _____

I certify under penalty of perjury under the laws of the State of California that the representations made in this Bid are true and correct.

SIGNED _____

TITLE _____

DATE _____

FORM OF BID BOND

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned _____

as Principal, and _____

as Surety, are hereby held and firmly bound unto San Antonio Water Company as owner in the penal sum of \$_____

(in words)

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.

Signed this _____ day of _____, 2019.

The condition of the above obligation is such that, whereas the Principal has submitted to the San Antonio Water Company a certain bid, attached hereto and hereby made a part hereof, to enter into a Contract in writing for:

CAMPUS AVENUE PIPELINE PROJECT

Located from: E. 20th Street to: E. 23rd STREET, Upland, CA

CO#1807-P

NOW, THEREFORE,

- a. If said Bid shall be rejected, or in the alternate,
- b. If said Bid shall be accepted and the Principal shall execute and deliver a Contract in the form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his/her faithful performance of said Contract and shall in all other respects perform the agreement created by the acceptance of said Bid.

Then this obligation shall be void; otherwise, the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Company may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first mentioned.

SEAL

PRINCIPAL

SURETY

BY: _____

BB-1

**SAN ANTONIO WATER COMPANY
CONSTRUCTION AGREEMENT**

CAMPUS AVENUE PIPELINE PROJECT
Located from: E. 20th Street to: E. 23rd Street, Upland, CA

CO#1807-P

THIS AGREEMENT is made and entered into this ____ day of _____, 2019, by and between the **San Antonio Water Company**, a Stockholder owned Mutual Water Company and California Corporation located in Upland, California, hereinafter called the OWNER, and by a _____ Contractor located in _____, California,

WITNESSETH: That the OWNER and CONTRACTOR have mutually covenanted and agreed with each other as follows:

1. THE CONTRACT DOCUMENTS. The complete Contract is comprised of and includes: The Notice Inviting Bids, Instructions to Bidders, the Non-Collusion Affidavit, the accepted Bid Proposal, the Construction Agreement and Bonds, the Certifications of Required Insurance Coverage and Endorsements, the Special Provisions, the Standard Specifications for Public Works Construction – Latest Edition, Modifications to Standard Specifications, the Plans and Drawings and associated permit(s), all Addenda or Supplemental amendments, provisions, regulations, ordinances, codes, and laws otherwise applicable to the work of improvements are incorporated as though fully set forth herein.

All of the above Documents are intended to cooperate so that any work called for in one and not mentioned in the other, or vice versa, is to be executed the same as if mentioned in all said Documents. The Documents comprising the complete Contract are hereinafter referred to as the Contract Documents.

2. THE WORK. CONTRACTOR agrees to furnish all tools, apparatus, facilities, equipment, labor and materials (except that specifically mentioned as being furnished by others) necessary to perform and complete the work in a good and worker like manner as called for, and in the manner designated in, and in strict conformity with the aforesaid Contract Documents.

3. CONTRACT PRICE. The OWNER agrees to pay, and the CONTRACTOR agrees to accept, in full payment for the work above agreed to be done, the prices set forth in the Bid Proposal \$ _____ as full compensation for fulfilling all obligations hereunder or as modified by any valid Contract change order. Said compensation shall cover all expenses, losses, damages, and consequences arising out of the nature of work during its progress or prior to its acceptance including those for well and faithfully completing the work and the whole thereof in the manner and time specified in the Contract Documents; and also including those expenses arising from actions of the elements, unforeseen difficulties or obstructions encountered in the prosecution of the work.

4. DISPUTES PERTAINING TO PAYMENT FOR WORK. Should any disputes arise respecting the true value of any work done or any work omitted, or of any extra work which the CONTRACTOR may be required to do, or respecting the amount of any payment to the CONTRACTOR during the performance of this Contract, said dispute shall be decided by arbitration in accordance with the prevailing rules and procedures of the American Arbitration Association and the arbitrators' chosen by the OWNER and the CONTRACTOR, and said

arbitrators' decision shall be final and conclusive. Under no condition shall there be a cessation of work by the CONTRACTOR during the dispute. This article does not exclude recovery of damages by either party for delays.

5. PAYMENT. Not later than the 1st day of each calendar month, a partial payment request, from the CONTRACTOR, will be provided to the OWNER for review, approval and funding on the basis of an estimate approved by the Engineer of the work performed since the CONTRACTOR's last partial payment request during the preceding month, if any, with ten (10) percent of the amount of each such estimate retained until the final and execution of a Notice of Acceptance of all work covered by this Contract. Payments due shall be made within 15-days of approval.

The Notice of Acceptance will be in letter form and will include the acceptance signature of the OWNER's representative. Release of CONTRACTOR's retention funds will be 36-days after the recording of the Notice of Completion.

6. TIME FOR COMPLETION AND DAMAGES. All work under this Contract shall be completed within a period of One Hundred Twenty (120) calendar days after the date the CONTRACTOR receives the Notice to Proceed, respectively, unless either period for completion is extended by the OWNER. CONTRACTOR and OWNER are aware of the damages, which may be incurred by OWNER if the Work is not completed within the time specified in this Agreement. Accordingly, OWNER and CONTRACTOR agree that the sum of \$800 per calendar day is a reasonable sum to assess as liquidated damages to OWNER by reason of the failure of CONTRACTOR to complete the Work within the time specified.

7. EXTENSION OF TIME. If the CONTRACTOR is delayed by the acts of negligence of the OWNER, or its employees or agents, or by changes ordered in the work, or by strikes, lockouts, fire, unavoidable casualties, or any causes beyond the CONTRACTOR's reasonable control, or by delay authorized by the OWNER, or by any justifiable cause which the Engineer shall authorize, then the CONTRACTOR shall make out a written claim addressed to the OWNER setting forth the reason for the delay and the extension of time requested and forward a copy of the claim to the Engineer for approval. The Engineer will evaluate the claim and if the claim is justifiable, will request the OWNER's approval. No such extension will be allowed unless written claim therefore has been delivered within three (3) calendar days after the delay became apparent.

This article does not exclude the recovery of damage for delay by either part under other provisions in the Contract Documents and CONTRACTOR specifically acknowledges that he has read and agrees to the provisions in the Contract Documents relating to liquidated damages.

8. INFORMATION AND REPORTS. The CONTRACTOR hereby agrees to provide all information and reports required by the Contract Documents or by Regulations pursuant thereto and shall permit access to its books, records, accounts, other sources of information and its facilities as may be determined by the OWNER to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information required of CONTRACTOR is in the exclusive possession of another who fails or refuses to furnish this information, the CONTRACTOR shall so certify to the OWNER, as appropriate, and shall set forth what efforts it has made to obtain the information.

9. **INDEMNITY AND LITIGATION.** To the fullest extent permitted by law, CONTRACTOR agrees to indemnify and hold harmless OWNER and all of its officers, directors, agents and employees from and against any and all claims, demands, or causes of action, including related expenses, attorney's fees, and costs, based in, arising out of, or in any way related to the Work performed by the CONTRACTOR, or anyone directly or indirectly employed by CONTRACTOR and for which the CONTRACTOR may be liable hereunder.

Should any litigation or arbitration be commenced between the parties hereto concerning said Work, any provision of this Agreement, or the rights and obligations of either in relation hereto, the party prevailing in such litigation shall be entitled, in addition to such other relief as may be granted, to a reasonable sum for its attorney's fees in such litigation, and related costs.

10. **INSURANCE.** CONTRACTOR shall procure and maintain insurance, for protection against claims. Without limiting CONTRACTOR's indemnification, CONTRACTOR agrees to procure and maintain, pursuant to the Specifications, at its sole cost and expense, in a form and content satisfactory to OWNER, during the entire term of this Agreement including any extension thereof, the following policies of insurance:

Coverage (Check if applicable)	Minimum Limits
(X) Comprehensive General Liability Insurance (including premises and combined operations) not auto	\$1,000,000 per occurrence single limit
() Contractual Liability Insurance Products Liability Insurance	\$1,000,000 limit
(X) Comprehensive Automobile Liability Insurance (including owned, non-owned, and hired automobile hazards)	\$1,000,000 per occurrence combined single limit
() Professional Liability Insurance (providing for a one-year discovery period)	\$1,000,000 per occurrence combined single limit
(X) Workers' Compensation/Employer's Liability Insurance	Statutory \$1,000,000 per occurrence

Conditions: In accordance with Public code Section 20170, the insurance of surety companies who provide or issue the policy shall have been Admitted doing business in the State of California with a credit rating of "A-" or better in the most recent edition of A.M. Best Company Rating guide, and only if they are of a financial category Class VIII or better, unless otherwise waived by the OWNER.

Any insurance maintained by the OWNER shall apply in excess of and not combined with insurance provided by this policy. The OWNER, its officers, directors, agents, employees and representatives shall be named as additional insured on this policy.

Prior to commencement of any work under this Contract, CONTRACTOR shall deliver to the OWNER the required insurance certificates and endorsements confirming the existence of the insurance required by this Contract and including the applicable clauses reference above and in the Contract Documents. Such endorsements shall be signed by an authorized representative of the insurance Company and shall include the signatory's Company affiliation and title. Should it be deemed necessary by the OWNER, it shall be the CONTRACTOR's responsibility to see that the OWNER receives documentation, acceptable to the OWNER, which sustains that the individual signing said endorsements is indeed authorized to do so by the insurance Company.

11. SUCCESSORS AND ASSIGNS. OWNER and CONTRACTOR hereby bind themselves, their successors and assigns to the other party hereto in respect to covenants, agreements, and obligations contained in this Agreement. Neither party hereto shall assign or attempt to assign this Agreement in part or as a whole without the prior written consent of the other party hereto.

12. NOTICE. Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the party's hereto or to an office of the party for which it was intended, or if delivered by registered or certified mail to the last business address known to the party giving the notice.

San Antonio Water Company
139 No. Euclid Avenue
Upland, California 91786
FAX: (909) 920-3047
Telephone: (909) 982-4107

13. GOVERNING LAW. This Agreement shall be governed by the laws of the State of California.

14. ENTIRE AGREEMENT. This Agreement constitutes the entire agreement between OWNER and CONTRACTOR and supersedes all prior written or oral understandings, except to the extent specifically referenced and incorporated herein. This Agreement may only be amended, supplemented, modified or canceled by a duly executed written instrument.

15. SEVERABILITY. Any provision or part of the Agreement held to be void or unenforceable under any law or regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Agreement shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision as close as possible to expressing the intention of the stricken provision.

16. TIME IS OF THE ESSENCE. The time periods in the Sequence of Work and Construction Schedule and the Time for completion are of the essence of this Agreement. By executing the Agreement, CONTRACTOR confirms that the time periods are reasonable for performing in accordance with the Contract Documents.

17. PARTIES HAVING PRINCIPAL INTEREST. CONTRACTOR affirms that the signatures, titles, and seals set forth hereinafter in execution of this Agreement represent all individuals, firm members, partners, joint ventures, and/or corporate officers having a principal interest herein.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their authorized officers, this Agreement in two (2) copies each of which shall be deemed an original and effective as of the date first written above.

OWNER:

CONTRACTOR:

Brian Lee - General Manager

Title: _____

PAYMENT BOND
(MATERIALS)

CAMPUS AVENUE PIPELINE PROJECT
Located from: E. 20th Street to: E. 23th Street, Upland, CA

CO# 1807-P

KNOW ALL PERSONS BY THESE PRESENTS: That we, _____,
as Principal, and _____,
a corporation organized and existing under the laws of the State of _____,
and duly authorized to transact business under the laws of the State of California, as
Surety, are held and firmly bound unto the SAN ANTONIO WATER COMPANY and to
any and all persons, companies or corporations entitled to file stop notices under
Section of the California Civil Code in the sum of (\$ _____),

(in words)

payable under the terms of the Agreement between _____

_____ and San Antonio Water Company, for which payment well and truly to be made, we bind ourselves, and heirs, executors and administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that, if said Principal or his/her subcontractors, shall fail to pay for any materials, provisions, provender, or other supplies or teams, implements or machinery used in, upon, for or about the performance of the Work Contracted to be done, or shall fail to pay any person, Company or corporation for any labor or work performed thereon of any kind, or for any amounts required to be deducted, withheld, and paid over to the Internal Revenue Service and/or Franchise Tax Board from the wages of employees of said Principal or his/her subcontractors, the Surety will pay for the same in an amount not exceeding the sum specified above. In case suit is brought upon this bond, the Principal and the Surety will pay a reasonable attorney's fee to be fixed by the court having jurisdiction in the case. In addition to the provisions herein above, it is agreed that this bond will inure to the benefit of any and all persons, companies and corporations entitled to serve stop notices, so as to give a right of action to them or their assigns in any suit brought under this bond.

No final settlement between the OWNER and the CONTRACTOR hereunder shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

(Signatures and attachments on second page)

IMPORTANT: Surety companies executing bonds must possess a certificate of authority from the California Insurance Commissioner authorizing them to write surety insurance defined in Section 105 of the California Insurance Code. Surety companies executing bond must also appear on the "Treasury List" of companies holding a Certificate of Authority as acceptable Surety on Federal Bonds and possess an underwriting authority limitation exceeding the Contract Amount.

In addition to the attachment of a Notary acknowledgment of the signatures hereto, a copy of the power of attorney to the local representatives of the Bonding Company must also be attached hereto.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, in the year _____.

Business name of Contractor

By: _____ (seal)

Title: _____

INDIVIDUAL _____ PARTNERSHIP _____ CORPORATION _____ OTHER _____

If OTHER, explain: _____

SURETY INFORMATION

SURETY NAME: _____

ADDRESS: _____

(seal)

TELEPHONE: () _____

SURETY SIGN: _____

TITLE: _____

NOTARY INFORMATION

"SIGNATURE OF SURETY MUST BE ACKNOWLEDGED BEFORE A NOTARY PUBLIC. PLEASE ATTACH APPROPRIATE ACKNOWLEDGMENT FORM."

PERFORMANCE BOND

*CAMPUS AVENUE PIPELINE PROJECT
Located from: E. 20th Street to: E. 23th Street, Upland, CA*

CO# 1807-P

KNOW ALL PERSONS BY THESE PRESENTS: That we, _____

_____ as Principal, and _____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business under the laws of the State of California, as Surety, are held and firmly bound unto the SAN ANTONIO WATER COMPANY and to any and all persons, companies or corporations entitled to file stop notices under Section of the California Civil Code in the sum of (\$ _____),

(in words)

payable under the terms of the Agreement between _____

_____ and San Antonio Water Company, for which payment well and truly to be made, we bind ourselves, and heirs, executors and administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that, if said Principal, its heirs, executors, administrators, successors or assigns shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the appended Agreement and any alteration thereof as provided, on his/her or their part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their intent and meaning; and shall faithfully fulfill the one-year guarantee of all materials and workmanship; and indemnify and save harmless the OWNER, its officers, directors, agents and employees as stipulated in the Agreement, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect. In case suit is brought upon this bond, the Principal and the Surety will pay a reasonable attorney's fee to be fixed by the Court having jurisdiction in the case.

The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Agreement or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration of addition to the terms of the Agreement or to the Work or to the Specifications.

No final settlement between the OWNER and the CONTRACTOR hereunder shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

(Signatures and attachments on second page)

IMPORTANT: Surety companies executing bonds must possess a certificate of authority from the California Insurance Commissioner authorizing them to write surety insurance defined in Section 105 of the California Insurance Code. Surety companies executing bonds must also appear on the "Treasury List" of companies holding a Certificate of Authority as acceptable surety on Federal Bonds, and possess an underwriting authority limitation exceeding the Contract Amount.

In addition to the attachment of a Notary acknowledgment of the signatures hereto, a copy of the power of attorney to the local representatives of the Bonding Company must also be attached hereto.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, in the year _____.

Business name of Contractor

By: _____ (seal)

Title: _____

INDIVIDUAL ____ PARTNERSHIP ____ CORPORATION ____ OTHER ____

If OTHER, explain: _____

SURETY INFORMATION

SURETY NAME: _____

ADDRESS: _____

(seal)

TELEPHONE: () _____

SURETY SIGN: _____

TITLE: _____

NOTARY INFORMATION

"SIGNATURE OF SURETY MUST BE ACKNOWLEDGED BEFORE A NOTARY PUBLIC. PLEASE ATTACH APPROPRIATE ACKNOWLEDGMENT FORM."

GENERAL PROVISIONS SECTION

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SAN ANTONIO WATER COMPANY GENERAL PROVISIONS

SECTION 1 “TERMS, DEFINITIONS, ABBREVIATIONS AND SYMBOLS”

The Standard Specifications for the San Antonio Water Company shall be the **STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, 1998 EDITION OR LATEST REVISION THEREOF** (sometimes hereinafter referred to as the *Green Book*), written and promulgated by the Southern California Chapter, American Public Works Association, and Southern California Districts Associated General Contractors of California Joint Cooperative Committee, including all published amendments thereto except for the following amendments, deletions and modifications.

Any conflict arising between these modifications and the Standard Specifications for Public Works Construction shall be resolved by the Engineer, whose decision shall be final.

Modifications to the Standard Specifications for Public Works Construction.

The following amendments, additions and deletions are hereby incorporated:

1-2 Definitions.

Acceptance, Final Acceptance – The formal action by the Owner accepting the Work as being complete.

Accepted Bid – the bid (proposal) accepted by the Owner (**added**).

Agency - As used in the Standard Specifications shall be the Company (**amended**).

Board - The Board of Directors of the Company (**amended**).

Company (or Owner) – The San Antonio Water Company, a stockholder Mutual Water Company and California Corporation, acting through its Board of Directors and General Manager.

County - County of San Bernardino (**added**).

City – City of Upland (**added**)

Engineer - The General Manager of San Antonio Water Company or his authorized and designated employee or agent (**amended**).

Federal - United States of America (**added**).

Laboratory - The official testing laboratory of the San Antonio Water Company or other laboratories designated, in writing, by the Engineer (**added**).

Special Conditions – Modifications to Detailed Technical Provisions (**added**).

Street - Any dedicated right of way for public use as an avenue, highway, lane, alley, court, crossing or intersection (**added**).

Substantial Completion – That date as certified by the Engineer when the construction of the Project

SAN ANTONIO WATER COMPANY GENERAL PROVISIONS

or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended **(added)**.

Written Notice – Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address or delivered in person to said party or his authorized representative on the Work **(added)**.

1-3.3 Institutions.

ACI - American Concrete Institute **(added)**.

AISI - American Iron and Steel Institute **(added)**.

A.S.M.E. - The latest American Society of Mechanical Engineers **(added)**.

PCA - Portland Cement Association **(added)**.

AWWA – American Water Works Association

ASTM – American Society for Testing and Materials

SAN ANTONIO WATER COMPANY GENERAL PROVISIONS

SECTION 1-6 “REQUIREMENTS AND CONDITIONS”

A new **Section 1-6** hereby is **added** to Section 1 of the *Green Book*, as follows:

1-6.1 Availability of Plans and Specifications: Plans and specifications may be examined at the San Antonio Water Company. Copies of the Notice to Bidders and proposal forms may be obtained from the San Antonio Water Company.

1-6.2 Approximate Estimate: The quantities given in the Notice to Bidders, proposal and contract forms are approximate only, being given as a basis for the comparison of bids, and the Agency does not, expressly or by implication, agree that the actual amount of work will correspond therewith. For work bid on a lump sum price basis, any estimate of quantities is provided for the convenience of Bidders and for comparison of bids and is not guaranteed to be correct by the Agency.

1-6.3 Examination of Plans, Specifications and Site of the Work: The Bidder shall examine carefully the site of the work contemplated and the proposal, plans, specifications and contract forms therefor. It will be assumed that the Bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality and quantities of work to be performed and materials to be furnished, and as to the requirements of these specifications, the plans and the contract.

The Bidder acknowledges satisfaction as to the nature and location of the work, the general and local conditions, particularly those bearing upon the availability of transportation, access to the site, disposal, handling and storage of materials, availability of labor, water, electrical power, roads and uncertainties of weather, physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during the prosecution of the work, and all other matters which can in any way effect the work or the cost thereof under this contract.

The failure or omission of any Bidder to receive or examine any contract Document, form, instrument, addendum, or other document or to visit the site and become acquainted with conditions then existing shall not relieve any bidder from obligations with respect to the bid or the Contract. The submission of a bid shall be taken as prima facie evidence of compliance with this Section. Bidders shall not at anytime after submission of the bid, dispute or assert that there were any misunderstandings in regard to the nature or amount of work.

1-6.4 Proposal Form: All proposals must be submitted on forms for that purpose furnished by the Company. Letters of transmittal cannot be considered as part of the bid. All proposals shall give the prices proposed, both in writing and figures, and shall be signed by the Bidder, who must give the Bidder's address. The Bidder shall fill out all blanks in the proposal form as therein required. In case of error, unit prices will govern over extensions and written words will govern over numerals, unless it can be established that an obviously incorrect entry has been made.

1-6.5 Rejection of Proposals Containing Alterations or Irregularities: Proposals may be rejected if they show any alterations of form, additions not called for, conditional bids, incomplete bids, or irregularities of any kind. When proposals are signed by an agent, other than an officer or manager of a corporation or a member of a partnership, a power of attorney or written authorization must be on file with the Agency prior to opening bids or shall be submitted with the proposal; otherwise, the proposal will be rejected as irregular and unauthorized.

SAN ANTONIO WATER COMPANY GENERAL PROVISIONS

1-6.6 Proposal Guaranty: All bids shall be presented in a sealed envelope and shall be accompanied by a "Proposal Guaranty" made payable to the Agency and for the amount equal to at least ten percent (10%) of the bid unless otherwise specified on the "Notice Inviting Sealed Bids or Proposals." Said guaranty shall be cash, an unconditional certified or cashier's check, or a bank or postal money order, or bid bond executed as surety by a corporation authorized to issue surety bonds in the State of California.

The check or bond of a Bidder to whom the Contract has been awarded will be returned to him after all of the acts, for the performance of which said security is required, have been fully performed. The checks or bid bonds of the second and third lowest Bidders will be returned when the Bidder to whom the Contract has been awarded has properly executed all of the required Contract Documents. Check or bid bonds of other Bidders will returned when their proposals are rejected or in any event, at the expiration of sixty (60) days form the date of opening bids.

1-6.7 Withdrawal of Proposals: Any bid may be withdrawn at any time prior to, but not after, the hour fixed in the public notice for the opening of bids, provided that a request in writing executed by the Bidder or the Bidder's duly authorized representative, for the withdrawal of such bid is filed with the Agency. The withdrawal of a bid shall not prejudice the right of a Bidder to file a new bid.

1-6.8 Disqualification of Bidders: More than one proposal from an individual, a firm or partnership, a corporation or an association under the same or different names will not be considered. Reasonable ground for believing that any Bidder is interested in more than one (1) proposal for the work contemplated will cause the rejection of all proposals in which such Bidder is interested. If there is reason for believing that collusion exists among the Bidders, none of the participants in such collusion will be considered in this or future proposals. Proposals in which the prices are unbalanced may be rejected.

1-6.9 Competency of Bidders: Except as required by California Public Contract Code § 20103.5, prior to the submission of bids, the Contractor shall be licensed in accordance with the provisions of Chapter 9 of Division III of the Business and Professions Code of the State of California and evidence of such license shall be presented to the Engineer on request. The Engineer may require the Bidder to present satisfactory evidence that the Bidder has sufficient experience and is fully prepared with the necessary capital, materials, machinery and skilled workmen to carry out the contract.

1-6.10 Material Guaranty: Before any contract is awarded, Bidders may be required to furnish a complete statement of the origin, composition and manufacture of any or all materials to be used in the construction of the work, together with samples, which samples may be subjected to the tests provided for in these specifications to determine their quality and fitness for the work.

1-6.11 Progress Schedule: The successful Bidder shall submit a progress schedule showing thereon the time proposed to be occupied in prosecuting the various major divisions of the work and the proposed sequence of operations.

SAN ANTONIO WATER COMPANY GENERAL PROVISIONS

SECTION 2 "SCOPE AND CONTROL OF WORK"

Section 2-1 of the *Green Book* hereby is **amended** to read as follows:

2-1 Award and Execution of Contract

2-1.1 Consideration of Bids: Bids will be opened publicly by the Agency's designated representative on the date and at the time set forth in the "Notice Inviting Sealed Bids or Proposals." The right is reserved by the Agency, by action of the Board, to reject any or all bids, to advertise for new proposals, to negotiate in the open market for a contract at a reasonable price, to purchase in the open market, or to have the work performed by Agency employees, or to abandon the work if, in the judgment of the Board, the best interests of the Agency will be promoted thereby.

2-1.2 Award of Contract: The award of the contract, if it were awarded, will be to the lowest responsible Bidder whose proposal complies with all the requirements prescribed. The award, if made, will be made within sixty (60) calendar days after the opening of the proposals unless otherwise specified in the "Notice to Bidders."

All bids will be compared on the basis of the Agency's estimate of the quantities of work to be done.

2-1.3 Return of Proposal Guarantees: All proposal guarantees will be held by the Agency until the contract has been signed, after which they will be returned to the respective Bidders whose proposals they accompany. If bids are rejected, the proposal guarantees will be returned after the date of the rejection.

2-1.4 Execution of Contract: The contract shall be signed by the successful Bidder and returned together with the contract bonds, within ten (10) calendar days after the Notice of Award of Contract has been mailed, unless otherwise specified by the Agency.

2-5.2 Precedence of Contract Documents: Section 2-5.2 is hereby amended as follows: Should there be a conflict between the Plans and the Specifications, the plans shall control over the specifications.

2-5.3 Shop Drawings and Submittals:

Section 2-5.3 hereby is **amended** by the addition of a new § 2-5.3.4:

2-5.3.4 Shop Drawing Corrections/Notations:

If one print of the drawing is returned to the Contractor **marked "NO EXCEPTIONS TAKEN"** or **"MAKE CORRECTIONS NOTED"**, formal revision and re-submittal of said drawing will not be required.

If one print of the drawing is returned to the Contractor **marked "AMEND RESUBMIT"** or **"REJECTED RESUBMIT"**, the Contractor shall revise said drawing and shall resubmit three (3) copies of said revised drawing to the Agency.

Fabrication of an item shall not be commenced before the Agency has reviewed the pertinent shop drawings and returned copies to the Contractor marked either **"NO EXCEPTIONS TAKEN"**,

SAN ANTONIO WATER COMPANY GENERAL PROVISIONS

“MAKE CORRECTIONS NOTED”, or “AMEND RESUBMIT.” Revisions indicated on shop drawings shall be considered as changes necessary to meet the requirements of the Contract Drawings and Specifications and shall not be taken as the basis for claims for extra work. The Contractor shall have no claim for damages or extension of time due to any delay resulting from the Contractor’s having to make the required revisions to shop drawings (unless a review by the Owner of said drawings is delay beyond a reasonable period of time and unless the Contractor can establish that the Agency’s delay in review actually resulted in a delay in the Contractor’s Construction Schedule). The review of said drawings by the Agency will be limited to checking for general agreement with the Specifications and Drawings and shall in no way relieve the Contractor of responsibility for errors or omissions contained therein nor shall such review operate to waive or modify any provision contained in the Specifications or Contract Drawings. Fabricating dimensions, quantities of material, applicable code requirements and other contract requirements shall be the Contractor’s responsibility.

Pipeline – In order to eliminate excessive field joints or closures, as well as undesirable change in vertical and horizontal alignment, bends, thrust restraints, and appurtenances, the Contractor shall conduct his clearing and benching operations far enough in advance to determine the need for any modifications in alignment prior to the preparation or submittal of shop drawings for approval. Shop drawings shall be submitted to the Engineer for the following items:

- a. Valves (all types)
- b. Piping and fittings (all types)
- c. Typical field welding details.
- d. Paint and joint sealer.
- e. Typical detail of connection to existing mains and specs for fittings to be used.
- f. Pumps & Motors
- g. Fencing
- h. Flow Meters
- i. Gauges
- j. Air/Vacs

2-9.2 Survey Service: Add the following paragraph at the end of § 2-9.2 of the *Green Book*:

The Owner shall provide necessary surveying adequate for construction, which will include grade and line stakes for the underground piping and appurtenances.

2.11 Inspection:

Add the following paragraphs at the end of § 2-11 of the *Green Book*:

The Contractor shall give the Engineer notice of the time when the Contractor or any subcontractor will start the various units or operations of the work. Notice shall be given at least forty-eight (48) hours in advance of starting or resumption time exclusive of Saturdays, Sundays or holidays, for the purpose of permitting the Engineer to make the necessary assignment of a representative or inspector on the work. Any work performed by the Contractor or subcontractor(s) in conflict with said notice shall be removed if so ordered by the Engineer or the representative or inspector on the work.

The inspection of the work shall not relieve the Contractor of any of the obligations to fulfill the contract as prescribed. Defective work shall be made good, and unsuitable materials may be rejected, notwithstanding the fact that such defective work or unsuitable materials may have been

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previously overlooked by the Engineer and accepted or estimated for payment.

Any project undertaken by the Agency in cooperation with, or under the control or supervision of, another public or quasi-public entity shall be subject, at all times, to inspection by the participating entity.

**SAN ANTONIO WATER COMPANY
GENERAL PROVISIONS**

**SECTION 3
“CHANGES IN WORK”**

3-2.1 General: Add the following paragraphs at the end of § 3-2.1 of the *Green Book*:

The Engineer shall approve change Orders that do not exceed the cumulative total of ten percent (10%) of the Contract amount.

Change Orders that exceed the cumulative total of ten percent (10%) of the Contract amount shall be reviewed and approved by the Board in advance of the actual work.

Where changes are necessary due to emergency needs and the cumulative total exceeds ten percent (10%) of the Contract amount, the Change Order shall be approved by the Engineer with subsequent ratification by the Board.

3-5.1 Retention of Imperfect Work: Add to § 3-5 of the *Green Book*:

If any portion of the Work done or materials furnished under the Contract proves defective or not in accordance with specifications and Contract drawings and if the imperfection in the same is not of sufficient magnitude or importance to make to Work dangerous or undesirable, or if the removal of such Work is unpractical or will create conditions which are dangerous or undesirable in the opinion of the Engineer the engineer shall have the right and authority to retain the work instead of requiring it to be removed and reconstructed but shall make such deductions therefor in the payment due the Contractor as may be just and reasonable.

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**SECTION 4
“CONTROL OF MATERIALS”**

4-1.2 Protection of Work and Materials: Add the following paragraph at the end of § 4-1.2 of the *Green Book*:

The Contractor shall properly safeguard all equipment, materials, and work against loss, damage, malicious mischief, or tampering by unauthorized persons until acceptance of the work by the Agency. Locked and covered storage or continuous surveillance by a watchman shall be provided if required to accomplish this purpose.

4-1.3.2 Inspection of Materials not locally produced: Add the following paragraph at the end of § 4-1.3.2 of the *Green Book*:

The Engineer may inspect the production of material, or the manufacture of products at the source of supply. Plant inspection, however, will not be undertaken until the Engineer is assured of the cooperation and assistance of both the Contractor and the material producer. The Engineer, or his duly authorized representative, shall have free entry at all times to such parts of the plants as concerns the manufacture or production of the materials. Adequate facilities shall be furnished free of charge to make the necessary inspection. The Agency assumes no obligation to inspect materials at the source of supply.

4-1.4 Test of Materials: Add the following paragraph at the end of § 4-1.4 of the *Green Book*:

The Company at its option may require testing and/or certification of soils and materials for this project. Any re-testing of soils or materials required by the engineer due to failure of the original test shall be at the Contractor's expense. All expenses incurred for obtaining samples and preparing and restoring field test sites, shall be the responsibility of the Contractor. Full compensation for conforming to the above requirements will be considered as included in the prices bid for various Contract items of Work and no additional compensation will be allowed therefor.

Testing of materials shall be provided by the Agency to insure compliance with Contract Specifications. The Contractor shall notify the Agency in writing two (2) working days in advance for any testing required maintaining progress without delays. Delays caused by the Contractor's failure to provide sufficient notice shall be the responsibility of the Contractor.

4-1.9 Title to Materials Found on the Work: A new § 4-1.9 is added to the *Green Book* as follows:

The Agency reserves the right to retain title to all soils, stone, sand, gravel, and other materials developed and obtained from excavations and other operations connected with the work. Unless otherwise specified in the Special Provisions, neither the Contractor nor any subcontractor shall have any right, title, or interest in or to any such materials. The Contractor will be permitted to use in the work, without charge, any such materials, which meet the requirements of the Specifications and Drawings.

**SAN ANTONIO WATER COMPANY
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**SECTION 5
“UTILITIES”**

[No Changes]

**SAN ANTONIO WATER COMPANY
GENERAL PROVISIONS**

**SECTION 6
“PROSECUTION, PROGRESS AND ACCEPTANCE OF THE WORK”**

6-7.2 Working Day

Add the following paragraphs at the end of § 6-7.2.1 of the *Green Book*:

CONSTRUCTION SCHEDULE:

The Contractor shall furnish a work schedule for the project to the Company and the Engineer as indicated in the Notice of Award. It shall indicate the estimated dates of completion of the various construction phases, from fabrication to field installation and connection to the existing systems.

The Owner reserves the right to alter this schedule in order to activate part of the project or coordinate its completion with other simultaneous construction projects.

The Contractor shall give the Engineer notice of the time when he or his subcontractors will start the various units or operations of the work. Notice shall be given at least forty-eight (48) hours in advance of starting or resumption time exclusive of Saturdays, Sundays or holidays, for the purpose of permitting the Engineer to make the necessary assignment of his representative or inspector on the work. Any work performed by the Contractor or his subcontractors in conflict with said notice shall be removed if so ordered by the Engineer or his representative or inspector on the work.

The inspection of the work shall not relieve the Contractor of any of his obligations to fulfill the contract as prescribed. Defective work shall be made good, and unsuitable materials may be rejected, notwithstanding the fact that such defective work or unsuitable materials may have been previously overlooked by the Engineer and accepted or estimated for payment.

Any project undertaken by the Agency in cooperation with, or under the control or supervision of, another public or quasi-public entity shall be subject, at all times, to inspection by the participating entity.

The first working day of the Contract shall be as indicated in the Contract and the Special Provisions and as follows:

Normal Day: Commencement of performance shall be ten (10) calendar days after date of written Notice to Proceed.

Urgent: No more than two (2) hours after receipt by Contractor of telephone notice to proceed from the City Engineer.

Emergency: No more than one-half (1/2) hour after receipt by Contractor of telephone notice to proceed from the City Engineer.

WORKDAY:

Normal: The Contractor's working hours shall be limited to the hours between 7:00 a.m. and 4:30 p.m. Monday through Thursday and 7:00 a.m. to 4:00 p.m. on Fridays, excluding the following recognized holidays. Deviation from normal working hours will not be allowed without prior consent

SAN ANTONIO WATER COMPANY GENERAL PROVISIONS

of the Company.

New Year's Day President's Day Memorial Day Independence Day Labor Day Thanksgiving Day (and day after) Christmas Day

In the event work is allowed by the Company outside of normal working hours, at the request of and for the benefit of the Contractor, inspection service fees may be levied against the Contractor at a rate of \$74.00 per hour, including travel time where applicable, with a minimum hourly charge for four (4) hours. Payment for inspection overtime will be deducted from the Contractors payment.

The above charge may also be levied if inspection services are deemed necessary by the Company as a matter of public safety or to otherwise insure the quality of the work.

Urgent: The Contractor's working hours shall be from 6:00 a.m. to 9:00 p.m., Monday through Saturday, excluding recognized holidays.

Emergency: The Contractor's working hours shall be any time, any day without exception.

If work is done at night, the Contractor shall provide adequate light for proper prosecution of the work, for the safety of the workmen and the public, and for proper inspection.

6-7.3 Contract Time Accounting

Section 6-7.3 of the *Green Book* is **amended** by changing the term "working days" to calendar days."

6-8 Completion and Acceptance. Add the following paragraph at the end of **§ 6-8** of the *Green Book*:

The Contractor shall provide a surety bond, prior to final pay release. The bond shall be in an approved form and executed by a surety company or companies satisfactory to the Agency, in the amount of ten percent (10%) of the contract price, or one thousand dollars (\$1,000.00), whichever is greater. Said bond shall remain in force for the duration of the guarantee period.

SAN ANTONIO WATER COMPANY GENERAL PROVISIONS

SECTION 7 “RESPONSIBILITIES OF THE CONTRACTOR”

7.0 All references in § 7 to the Division of Industrial Safety shall mean the State Division of Occupational Safety and Health, or its successor agency or agencies.

Section 7-2.2 of the *Green Book* hereby is **amended** to read:

7-2.2 Laws to be Observed: The Contractor shall keep fully informed of all State and National laws and all municipal ordinances and regulations of the Agency which in any manner affect those engaged or employed in the work, or which in any way affect the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same.

The Contractor shall at all times observe and comply with, and shall cause all of the Contractor's agents, employees and subcontractors to observe and comply with all such laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Agency, the Board and the Engineer, and all of its and their elected and appointed officials, officers, agents and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by the Contractor or the Contractor's employees. If any discrepancy or inconsistency is discovered in the plans, drawings, specifications or contract for the work in relation to any such law, ordinance, regulation, order or decree, the Contractor shall forthwith report the same in writing to the Engineer.

7-2.2.6 Contractor's Responsibility for Work: Until the formal acceptance of the work, the Contractor shall have the charge and care thereof, except as provided in § 7-2.2, and shall bear the risk of injury or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore and make good all injuries or damages to any portion of the work occasioned by any cause before final acceptance and shall bear the expense thereof, except such injuries or damages as occasioned by Acts of War.

In case of suspension of Work from any cause whatever, the Contractor shall be responsible for all materials and the proper temporary storage thereof.

7-2.2.7 Correction of Errors, Recovery for Errors, Dishonesty or Collusion: The Agency reserves the right to correct any error that may have been made in any estimate that has been paid. The Agency also reserves the right to claim and recover, by process of law, any sums sufficient to correct any error or make good any deficiency in the work resulting from such error or from dishonesty or collusion between any of the parties or individuals having dealings pursuant to the construction of the work, regardless of when such error, dishonesty or collusion shall be discovered.

7-2.2.8 Rights in Materials and Salvage: Ownership of material incorporated in the work is vested in the name of the Agency. Any material delivered and paid for in part by the Agency or any material furnished by the Agency to be incorporated in the work, is or becomes the property of the Agency. Any salvageable materials or installations existing at the site of the work (such as valve boxes and other steel, cast iron or metallic materials) that are the property of the Agency, if they are to be removed, shall be delivered F.O.B. (Free on Board) to the storage yard designated by the Agency. The salvageable materials shall be cleaned of clinging concrete and debris and delivered to the storage yard in the same condition as it existed prior to removal, unless the Engineer instructs the Contractor otherwise.

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7-2.2.9 Warranty of Title: No materials, supplies or equipment for the work under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale Contract or other agreement by which an interest therein or any part thereof is retained by the seller or supplier. The Contractor warrants clear and good title, to all materials, supplied and equipment installed and incorporated in the Work, and agrees upon completion of all work to deliver the premises, together with all improvements and appurtenances constructed or placed thereon by him, to the company free from any claims, liens, encumbrances or charges, and further agrees that neither he nor any person, firm, or corporation furnishing any material or labor for work covered by the Contract shall have any right to a lien upon the premises or any improvement installing metering devices or other equipment of utility companies the title of which is commonly retained by the utility Company. Nothing contained in this article, however, shall defeat or impair the right of such persons furnishing materials or labor under any bond given by the Contractor for their protection, or any right under any law permitting such persons to look to funds due the Contractor, which are in the hands of the Company. The provisions of this article shall be inserted in all subcontractors and material Contracts and notices of its provisions shall be given to all persons furnishing materials for the work when no formal Contract is entered into regarding such materials.

Section 7-3 of the *Green Book* hereby is **deleted**, in its entirety. **Insurance requirements are set forth in the contract.**

7-7 Cooperation and collateral work.

The contractor is advised of the performance of other work on site requiring coordination and scheduling of tasks and responsibilities as referenced in this section of the *Green Book*.

7-15 Notice and Service Thereof: Add § 7-15 to the *Green Book*:

Any notice required or given by one party to the other under the Contract shall be in writing and shall be dated and signed by the party giving such notice or by a duly authorized representative of such party. Any such notice shall not be effective for any purpose whatever unless served in the following manner:

Notice shall be given to the Company by personal delivery thereof to the Engineer or by depositing the same in the United States mail enclosed in a sealed envelope, registered and with postage prepaid, addressed to:

**General Manager
San Antonio Water Company
139 North Euclid Avenue
Upland, California 91786**

Notice shall be given to the Contractor, by personal delivery thereof to said Contractor or to his authorized representative at the site of the project, or by depositing the same in the United States mail, enclosed in a sealed envelope addressed to said Contractor at the address established for the conduct of the Work under this Contract, postage prepaid and registered.

Notice shall be given to the Surety, or any other person, by personal delivery to said Surety or other person, or by depositing the same in the United States mail, enclosed in a sealed envelope addressed to such Surety or persons at the address of said Surety or persons last communicated by him to the party giving the notice, postage prepaid and registered.

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GENERAL PROVISIONS**

**SECTION 8
“FACILITIES FOR AGENCY PERSONNEL”**

[No Changes]

**SAN ANTONIO WATER COMPANY
GENERAL PROVISIONS**

**SECTION 9
“MEASUREMENT AND PAYMENT”**

9-3.1 General: Add to this section of the *Green Book* as follows:

Retention funds will be released pursuant to the Public Contract Code Section 7107 except as may be provided for in Civil Code Section 3179 ET. Seq.

9-3.2 Partial and Final Payment: Amend this section of the *Green Book* as follows:

The Contractor, at the pre-construction meeting, shall provide a breakdown of Lump Sum prices by preparing a Schedule of Values, with estimates of completed work on each of the various elements of work on which to base applications for partial payments. The breakdown shall be a true representation of the price for the work covered by the Specifications and Drawings and shall be subject to acceptance by the Engineer. An unbalanced breakdown will not be acceptable. The values assigned to the price breakdown will be used only as a basis for partial payments and not as a basis for additions to or deletions from the Contract Price.

On the 5th day of each month the Contractor shall submit, to the Engineer, a written progress estimate of the work completed. The Engineer will review the estimate and approve it or notify the Contractor of any exceptions. No such progress estimate will be required, and no payment will be made when the total number of working days is twenty-five (25) or less or when the value of the work totals less than \$500.00.

Progress payments made after the scheduled completion date shall not constitute a waiver of liquidated damages.

The Contractor may, at Contractor's sole cost and expense, substitute securities equivalent to any monies withheld by the owner to insure performance under the Contract. Such security shall be deposited with the owner or a state or federally chartered bank as escrow agent, who shall pay such monies to the Contractor upon satisfactory completion of the Contract. The Contractor shall be the beneficial owner of any security substituted for monies withheld and shall receive any accrued interest thereon. Securities eligible for investment shall include those listed in government Code Section 16430 or bank or savings and loan certificates of deposit.

WORK PERFORMED WITHOUT DIRECT PAYMENT

Whenever the Contractor is required to perform work or furnish equipment, labor, tools and materials of any class for which no price is fixed in the proposal, it shall be understood that such work, equipment, labor, tools and materials shall be provided without extra charge, allowance, or direct payment of any kind. The cost of performing such work or furnishing such equipment, labor, tools and materials shall be included in the unit bid prices in the Proposal and no additional compensation will be made therefor.

SPECIAL PROVISIONS SECTION

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SAN ANTONIO WATER COMPANY SPECIAL PROVISIONS

SECTION 1 “GENERAL REQUIREMENTS”

1.01 DESCRIPTION OF WORK

The Contractor shall furnish, in accordance with the Specifications, drawings, Mitigation Measures and conditions of the Initial Study, Storm Water Permit, City of Upland permits, and San Bernardino County permits, all plant, labor, equipment, and materials required for the construction of the project stated in the Contract Documents and Bidding Schedule.

1.02 SEQUENCE OF WORK

Prior to starting construction, the Contractor shall submit to the Owner a schedule, which shall coordinate the various construction phases, from fabrication to field installation and connection to the existing systems pursuant to Section 7-7 of the Green Book.

The Owner reserves the right to alter this schedule in order to activate part of the project or coordinate its completion with others simultaneous construction projects.

1.03 COMPLETION OF WORK

All work must be substantially completed within the time specified in the Contract Documents. Final completion including re-pavement of asphalt surface and clean up must be completed within the time specified in the Contract Documents as well as the conditions set forth in the permit issued by the governing agency. ***If the Contractor does not complete the contracted work in the time allocated per the Specifications and the Notice to Proceed, he shall be liable to the Company for all inspection time for each day after the established Contract completion date that the work remains incomplete. He shall remain liable until the job is approved and accepted by the Company (for extension of time, see General Provisions, Section 6-6.2).***

1.04 LIQUIDATED DAMAGES

The Contractor shall, as provided in Section 6-9 of the General Provisions, pay to the Company as fixed, agreed, and liquidated damages for each calendar days delay, in substantial completion and final completion of the work beyond the time agreed upon, the amount of **\$800.00** per calendar day.

1.05 PRE-CONSTRUCTION MEETING

Following award of Contract, but prior to commencement of work, the Contractor shall schedule a meeting with the Owner, City & County Inspectors, and affected utilities to review proposed construction and shall furnish the following items:

- (A) A schedule of completing the principal items of work (Construction Schedule).
- (B) Projection of monthly payments to be earned (if applicable)
- (C) A list of names, titles, addresses, and telephone numbers of the Contractor's responsible personnel indicating those who may be reached outside of normal working hours for emergency response.
- (D) Provide a signed document stating that the Contractor has contacted the City of Upland Police Department, the City of Upland Fire District, County Fire District and the Chaffey Unified School District (Bus Division) of notification of commencement of work.
- (E) Shop Drawings. All understandings, interpretations and agreements reached at said conference shall be reduced to writing by the Owner and mailed to all parties attending said pre-construction conference.

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1.06 FAILURE TO COMPLY

If the Contractor cannot be contacted or fails to respond or refuses to comply with instruction given by the City Permit Inspector then, the Company may take corrective action as necessary to protect the roadway and traveling public. The Contractor shall reimburse the Company for any such costs thereof.

1.07 CONSTRUCTION UTILITIES

(A) POTABLE WATER - All drinking water on the site, during construction, shall be furnished by the Contractor and shall be bottled water or water furnished in approved dispensers.

(B) CONSTRUCTION WATER – Water for construction, dust control, testing, compaction and other phases of the work requiring water, shall be furnished by the Contractor at his own expense and no additional allowance will be made therefore. The Contractor shall comply with all regulations of the appropriate Water and Fire agencies regarding connection to fire hydrants or standpipes.

The Contractor is advised to contact the appropriate agency regarding the availability of water, cost of hydrant meter & cost of water.

The cost for water shall be included in the lump sum bid of the work and no additional allowance will be made therefor.

1.08 PERMITS AND LICENSE

At his own expense, the Contractor shall apply and obtain all construction permits (i.e., City of Upland permit, Storm Water Permit) and licenses required for the execution of work under this Contract. See section 10.0 for required permit forms to be completed and submitted to the City of Upland.

1.09 PRIVATE PROPERTY

Any private property damaged by the Contractor's operations shall be repaired or replaced in kind by the Contractor at his own expense and to the satisfaction of the property owner and/or the Company's Inspector.

1.10 AS-BUILT DRAWINGS

The Contractor shall maintain on the job site a set of full-size blue-line drawings. On these, he shall mark all as-built conditions, locations, configurations, and other details shown on the original Contract Drawings. Upon completion of work and prior to final acceptance, the as-built drawings shall be turned over to the Company.

1.11 PROTECTION OF EXISTING UTILITIES

The Contractor shall exercise his best effort and care to protect existing utilities (water lines, gas mains, power poles, etc.) against damage from his operations. All damages shall be repaired by the Contractor at his own expense.

1.12 CONSTRUCTION STAKING

The Company shall provide for all field staking during construction per Section 2-9.5 of the General Provisions. ***The Contractor shall provide the Company with five (5) working days advance notice of any required survey staking.***

1.13 BID ITEM FOR SAFETY MEASURES

Each bid proposal submitted under these Specifications for the construction of a pipeline, or similar trenches or open excavations, which are five (5) feet or deeper, or the use of such a trench or open excavation shall contain a separate bid item to provide sheeting, shoring and bracing, or equivalent method, for the protection of life or limb, which shall conform to applicable safety orders, including the

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Construction Safety Orders of the California Division of Industrial Safety, in accordance with the requirements of the California Occupational Safety and Health Act.

Nothing in this requirement shall be construed to impose tort liability on the awarding body or any of its employees.

1.14 TRENCH SHORING APPROVAL

Any contract for excavation of any trench or trenches five (5) feet or more in depth, the Company shall require submission by the Contractor and acceptance by the awarding body or by a Registered Civil or Structural Engineer to whom authority to accept has been delegated, in advance of excavation, a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches. This plan shall be prepared by a Registered Civil or Structural Engineer.

Nothing in this Section shall be deemed to allow the use of a shoring, sloping, or protective system less effective than that required by the safety standards set forth by the State of California Safety Requirements.

Nothing in this Section shall be construed to impose tort liability on the awarding body or any of its employees.

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SECTION 2 "EARTHWORK"

2.01 GENERAL

The Contractor shall perform all earthwork required for construction of the proposed improvements as specified and shown. Earthwork includes all plant, labor, equipment, and materials, as required or necessary to clear shrub, excavate, trench, fill, backfill, and grade for the construction of all structures, pipe lines, ditches, embankments, and graded areas.

2.02 UNKNOWN UNDERGROUND FACILITIES

The Company has attempted to show all known underground facilities on the plans. The Contractor's attention is directed to the possible existence of pipe and other underground improvements, which may or may not be shown on the plans. ***The Contractor shall request Underground Service Alert sufficiently ahead of his excavation (72 hours minimum) to correctly locate the existing underground facilities.*** When the exact location of a utility becomes doubtful, the Contractor shall excavate and expose the utility ahead of trenching operations. The inspector representing the Engineer of Work may adjust the alignment of the pipeline to provide the least amount of interference with the utility as determined by the inspector. All reasonable precautions shall be taken to preserve and protect any such improvements whether shown on the plans or not. Where it is necessary to remove and replace or to relocate such improvements in order to prosecute the work, they shall be removed, maintained, and permanently replaced following a review by the Company and owners of the utility.

2.03 GRADING

In addition to the requirements herein set forth for piping and structural earthwork, all shall be in accordance with the requirements of any other agencies having jurisdiction.

2.04 GENERAL EXCAVATION

Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown or ordered.

Unless otherwise provided, the areas of construction shall be stripped of all vegetation and debris and such material shall be removed from the site prior to performing any excavation or placing any fill. Excavated material suitable for backfill shall be stored temporarily in such a manner as will facilitate work under the Contract.

Any damage done to private property by reason of work on easements shall be the responsibility of the Contractor. Fences and landscaping, which are removed or damaged by the Contractor, shall be restored to their original condition at the Contractor's expense.

The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other approved measures for the removal or exclusion of water, including taking care of storm water reaching the site of the work from any source so as to prevent damage to the work or adjoining property.

Excavation shall be sloped or otherwise supported in a safe manner in accordance with applicable state and federal industrial safety requirements. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to prevent accidents. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled. All excavations shall be performed, protected, and supported as required for safety and in the manner set forth in the operating rules, orders, and regulations prescribed by the Division of Industrial Safety of the Department of Industrial Relations of the State of California.

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2.05 PIPELINE TRENCH EXCAVATION

Unless otherwise shown or ordered, excavation for pipelines, fittings, valves, and appurtenances, shall be open-cut trenches. The bottom of the trench shall have a minimum width equal to the outside diameter of the pipe plus 12 inches and a maximum width equal to the outside diameter of the pipe plus 20 inches. Except when otherwise shown or ordered by the Company, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be required.

(A) TRENCH OVER-EXCAVATED WHERE SHOWN - Trenches shall be over-excavated where shown, to the depth shown, and backfilled to the grade of the bottom of the pipe with suitably selected granular material or with sand. Said backfill shall be brought to optimum moisture content and compacted to 95 percent of maximum dry density where the pipeline trench passes under structures, and 90 percent elsewhere. Work specified in this subsection shall be performed by the Contractor at his own expense.

(B) TRENCH OVER-EXCAVATED WHEN ORDERED - Trenches shall be over-excavated beyond the depth shown, when ordered by the Inspector and in areas where poor soil (soft, spongy, or unstable material) or rock is encountered. Such over-excavation shall be to the depth ordered by the Inspector. The trench then shall be refilled to the grade of the bottom of the pipe with either selected granular material obtained from the excavation, sand, or crushed rock, at the option of the Company. When crushed rock bedding is ordered, the material shall be a well-graded material (Class II Aggregate Base). Bedding shall be placed in layers, brought to optimum moisture content, and compacted to 95 percent of maximum dry density where the pipeline trench passes under structures and 90 percent elsewhere. All work specified in this Subsection shall be performed by the Contractor at his own expense when the over-excavation ordered by the Company is less than 6 inches below the limits shown. When the over-excavation ordered by the Company is 6 inches or greater below the limits shown, additional payment will be made to the Contractor for that portion of the additional payment will be made under a separate unit price bid item for over-excavation and bedding if such bid item has been established. Otherwise, payment will be made in accordance with a negotiated price for execution of a change order.

(C) OVER-EXCAVATION NOT ORDERED, SPECIFIED, OR SHOWN - Any excavation carried below the grade ordered, specified, or shown, shall be refilled to the required grade with suitably selected granular material. Such material shall be moistened as required and compacted to 95 percent of the maximum dry density under structures and 90 percent elsewhere. The Contractor at his own expense shall perform such work.

2.06 SITE GRADING

After stripping has been done, all areas covered by the work, including excavated and filled sections shall be graded uniformly to the lines and grades indicated on the Drawings. The finished surface shall be reasonably smooth and well compacted. All excavated material suitable for fill shall be transported to and placed in the fill area within the limits of the work. All excavated materials which are unsuitable for fill shall be disposed of by the Contractor at his own expense. During construction, excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Ditches shall be cut accurately to the cross-sections and grades indicated. Any excessive ditch excavation shall be backfilled to grade with suitable, thoroughly compacted material or with suitable stone or cobble to form an adequate paving.

2.08

2.07 ROCK EXCAVATION AND BLASTING

Rock excavation shall include removal and disposal of the following:

- (a) All boulders measuring 1/3 of a cubic yard or more in volume
- (b) All rock material in ledges, bedding deposits, and un-stratified masses which cannot be removed without systematic drilling and blasting

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- (c) Concrete or masonry structures which have been abandoned
- (d) Conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock and which cannot be removed without systematic drilling and blasting.

Said rock excavation shall be performed by the Contractor at his own expense, provided that should the quantity of rock excavation be affected by any change in the scope of the work, and appropriate adjustment of the Contract price will be made under a separate additive-deductive bid item if such bid item has been established. Otherwise, payment will be made in accordance with a negotiated price.

All operations, storage, and handling of explosives shall be according to provisions of Division II, Part I, of the Health and Safety Code, State of California, and shall comply with all State, County, and local laws. Drilling and blasting are to be done only by personnel skilled in such operations. All necessary precautions shall be taken for protection of life and property. Warnings shall be given to nearby property owners that blasting is in progress. Safety mats shall be used to restrict flying particles. The Contractor shall size each blast to minimize nuisance and reduce the possibility of damage to local structures.

2.08 DISPOSAL OF EXCESS EXCAVATED MATERIAL

The Contractor shall remove and dispose of all excess excavated or waste material at his own expense.

Excavated material shall not be deposited on private property unless the Contractor furnish written permission, duly assigned by the owner of the private property involved, to the owner before such material is placed on private property.

2.09 BACKFILL (GENERAL)

Backfill shall not be dropped directly upon any structure or pipe. Materials used for backfill shall be selected material, free from grass, roots, brush, or other vegetation, or boulders having maximum dimension larger than twelve inches. Material coming within six inches of any structure or pipe shall be free of rocks or unbroken masses of earthy materials having maximum dimensions larger than three inches. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

Whenever the excavated material is unsuitable for backfill, the Contractor shall arrange for and furnish imported backfill material at his own expense.

All compaction shall be done in accordance with the applicable City requirements and regulations

2.10 PIPELINE TRENCH BACKFILL

- (A) Pipeline trenches shall be backfilled to a level 12 inches above the top of the pipe with selected sandy material obtained from the excavation; provided if, in the Engineer's opinion, said material is unsuitable for backfill purposes, imported material having a sand equivalent value of not less than 20 shall be used for this portion of the trench backfill. Imported sand backfill, when ordered by the Engineer, will be paid for under a separate unit price bid item if such bid item has been established; otherwise, payment will be made in accordance with negotiated price. Such material shall be compacted to 85 percent of maximum dry density.
- (B) After the initial portion of backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the remainder of the trench may proceed. The remaining portion of the backfill shall be selected material obtained from the excavation per Section 2.12. Each layer shall be moistened and placed in horizontal layers. Each layer shall be tamped, rolled or otherwise compacted to 95 percent of maximum dry density where the trench is located under structures and 90 percent of maximum dry density within the top 3 feet.

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- (C) Backfill around and beneath structures, and beneath paved areas except where otherwise specified for a particular structure or ordered by the Engineer, backfill placed around and beneath structures, and beneath paved areas, shall be placed in horizontal layers not to exceed 8 inches in thickness, as measured before compaction, where compaction is attained by mechanical means. Where the use of sheepsfoot rollers is impractical, the layers shall not exceed 6 inches in thickness before compaction, and compaction shall be attained by means of hand-operated power-driven tampers. The backfill shall be brought up evenly with each layer moistened and compacted by mechanical means to 95 percent of maximum dry density beneath structures and beneath paved areas, and 90 percent of maximum dry density around the sides of structures within the top 3 feet of the top of pipe.

2.11 COMPACTION TESTS

All compaction tests required by the Company shall be performed by the Company or its agent at the Company's expense. However, in the event these tests prove the compaction to be unacceptable to either the governing agency or the Owner, all cost for subsequent test will be deducted from the progress payments to the contractor.

In-place soil densities shall be determined by testing in accordance with the latest published edition of the ASTM D-1556 sand cone method or ASTM D-2922 for nuclear method.

Optimum soil moisture-density relations shall be established in accordance with the method of test specified in the latest published edition of ASTM Standard D-1557 method C.

In either case, the tests will be scheduled within 24 hours of the Contractor's request for tests, at locations to be selected by the Owner and/or the governing agency. However, tests shall not be scheduled until a minimum 4 hours work is available for the testing laboratory, as determined by the Engineer. Results of these tests shall then be available within 24 hours.

Required depth for testing relative compaction will be at top of pipe zone and every 3 feet thereafter. (Reference standard trench repair detail)

In accordance with provisions for guarantee of the work, the Contractor shall return at his expense to correct any backfill conditions subsequently found to be substandard by either failure or more extensive testing. The Contractor shall provide all labor and equipment necessary to prepare for all tests and to assist the soils engineer in taking the tests, as directed by the Engineer. The Contractor's attention is directed to additional provisions related to testing contained in Section 4-1.4 of the General Provisions.

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**SECTION 3
“ASPHALT PAVING”**

3.01 GENERAL

This Section covers the furnishing and placement of asphalt concrete required for the repair and replacement of pavement along streets, private driveways, drainage easements and parking areas damaged by Contractor's operations. Where pavement is within the rights-of-way of the State Division of Highways, the County Transportation Department, County Flood Control District, and any City of other governmental agency having jurisdiction, paving shall be done in accordance with the requirements and the provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these specifications. These technical specifications shall be the minimum requirement. In any case, the highway surface excavated or damaged by the Contractor shall be replaced in as good or better condition as the same was before such work was begun.

3.02 TEMPORARY PAVEMENT REPAIR

Place a minimum of 3 inches of aggregate base bedding material in the trench, then place 2 inches of compacted “cold mix” or regular asphalt concrete flush with existing pavement surface. On primary roads, after tacking the existing pavement and placement of base, AR 4000, Type B, 1/2-inch maximum hot mixed asphalt concrete shall be placed and compacted to finish grade

3.03 PERMANENT PAVEMENT REPAIR

Shall be performed by a licensed paving contractor.

3.04 SPREADING AND ROLLING EQUIPMENT

- (A) All distribution and spreading equipment shall conform to the Standard Specifications for Public Works Construction, Section 302-5.5. Additionally, all self-propelled vibrating screen paving machines shall have no more than a (1) foot extension on its spreader box.

- (B) All rolling equipment shall conform to the Standard Specifications for Public Works Construction Section 302-5.6.

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SECTION 4 "MATERIAL"

4.01 MATERIALS FURNISHED BY THE CONTRACTOR

Except as otherwise stated on the bidding sheets, these Special Provisions, or ordered by the Company, all material shall be furnished by the Contractor. Contractor shall furnish all material noted with the following provisions applying:

- (A) The Contractor shall furnish the Company, as soon as issued duplicate copies of all orders placed outside the Contractor's plant for articles or materials to be furnished by the Contractor for incorporation in the work.
- (B) The Contractor shall also furnish the Company with Certificates of Compliance respecting the character of the material to be used.

SAN ANTONIO WATER COMPANY SPECIAL PROVISIONS

SECTION 5 “INSTALLATION OF STEEL PIPE”

5.01 GENERAL

The work covered in this section includes the furnishing, installation, and testing of pipe, fittings, and all required appurtenances as shown on the plans. Water line shall be either ductile iron pipe (DIP), or steel pipe (CLML&W steel or CML& steel) as specified herein. In addition to the referenced AWWA Standards, pipe handling, storage and installation shall be in accordance with the following instructions.

- (A) **INSPECTION** - Examine the pipe and fittings for cracks, dents, abrasions, or other flaws prior to installation. Mark defective pipe and remove from the site.
- (B) **DUCTILE PIPE AND FITTINGS** - Install DIP per AWWA Standard C600. Proper and suitable tools and appliances for safe handling of pipe and fittings shall be employed. Care shall be exercised to avoid damage to pipe and fittings. All pipe and fittings shall be carefully examined by the Contractor for defects at the time of laying, and no defective pipe or fittings shall be installed. The engineer may waive rejection on the condition that cradling, or encasement is provided, or the corrective measures taken. All such work shall be done at the Contractor's expense. All pipe and fittings shall be thoroughly clean at the time of installation and shall be handled in such a manner as to maintain this condition by preventing the entrance of foreign material. Whenever workmen are absent from the job site, open ends of pipe shall be kept plugged. Each section of pipe shall be accurately laid to the required line and grade and shall have a firm bearing for its full length except for a minimum distance at bell holes. After the socket and plain end are wiped clean of all sand and dirt, the plain end should be entered into the socket. It is essential that pipe and fittings be kept level and in straight alignment and that the pipe sections be pulled together slowly to assure proper installation. Joints shall not be deflected beyond the maximum values as specified by the manufacturer.
- (C) **STEEL PIPE**— Steel pipe shall be cement lined and coated (CML & C) for buried pipe and (CML & painted for above ground installations. Installation shall be in accordance with Section 207-10 “Steel Pipe” of the Standard Specifications for Public Works Construction, 1997 Edition, the project plans and the Special Provisions of the San Antonio Water Company. Pipe shall standard steel cylinder with weld ends. All joints shall be solid welded.

The cement mortar coating on buried steel pipe in the vicinity of couplings shall be removed to facilitate the installation of the coupling. The extent of coating removal shall be only the minimum required for proper installation and function of the coupling.

Trench excavation, bedding and structure backfill shall be in accordance with the San Antonio Water Company's Typical Backfill Schematic.

Full compensation for furnishing all labor, materials, tools, equipment and incidentals for doing all the work involved in the construction of CML&C steel water main, complete in place, shall be considered as included in the contract unit price per lineal foot paid for CML&C water main, and no additional compensation will be allowed therefor.

- (D) **FITTINGS** – Water main fittings, tees, bends and reducers shall be made of the same material and finish as the main line. Couplings, adapters, flanges and other appurtenances shall be in conformance with the San Antonio Water Company Special provisions covering construction materials. Steel welded fittings, which meet the San Antonio Water Company Special Provisions, are acceptable for bends and reducers.

**SAN ANTONIO WATER COMPANY
SPECIAL PROVISIONS**

Full compensation for furnishing all labor, materials, tools, equipment and incidentals for doing all the work involved in the construction of the water main fittings, tees, bends and reducers, complete in place, shall be considered as included in the contract unit price for the fitting, tee, bend or reducer and no additional compensation will be allowed therefor.

**SAN ANTONIO WATER COMPANY
SPECIAL PROVISIONS**

**SECTION 6
“INSTALLATION OF VALVES, HYDRANTS, AND FITTINGS”**

6.01 VALVES

Unless otherwise indicated on the plans, all line valves shall be buried with the exception of all geared valves (or any other valves indicated on the plans), which shall be set in valve vaults or manholes. The operating nut on a buried valve shall be readily accessible for operation through a valve box which has been set to finish grade and in a vertical position. Rubber ring grooves of valves shall be inspected before installation by the Contractor for ridges or holes, which would interfere with the rubber ring. Interference with the rubber ring shall be corrected to a satisfactory connection or the valves replaced, as required by the Company. All valves shall have the same rubber-ring groove profile as the profile in the groove on the pipe couplings furnished with the pipe. All gate valves shall be anchored in concrete as specified by these Special Provisions and Standard Drawings herein. The anchor shall bear against undisturbed ground in all cases, except where unstable conditions are encountered, in unstable conditions, the bearing surface shall be as directed by the Inspector

Valve boxes shall be firmly supported and shall be kept centered and plumb over the wrench nut of the valve; the box cover shall be flush with the surface of the finished pavement or at any other level designated by the Inspector.

6.02 AIR AND VACUUM RELEASE VALVES

Air and vacuum release valves shall be installed as shown on the job plans.

**SAN ANTONIO WATER COMPANY
SPECIAL PROVISIONS**

**SECTION 7
“THRUST BLOCKS AND ANCHOR BLOCKS”**

7.01 GENERAL

Anchors and thrust blocks shall be constructed as shown on the Standard Drawings or where directed by the Inspector and as specified herein. In general, thrust blocks and anchors will be placed at all angles greater than five degrees, at changes in pipe size, at cast-iron fittings, and at hydrant locations.

Steel rods used for tie downs and enforcement shall be Rebar No. 4 coated with Minnesota Mining and Manufacturing EC44, Koppers Bitumastic 505 (Supertank), or an approved equal.

Concrete used will be a minimum class rating of 450-C-2000.

7.02 THRUST BLOCKS

The area and design of the bearing surface shall be as specified by the Standard Drawing for thrust blocks. The bearing surface shall be against undisturbed ground in all cases, except where unstable conditions are encountered. In unstable conditions, the bearing surface shall be as directed by the Inspector. Unless otherwise directed by the Inspector, the thrust blocks shall be placed so that the pipe and fitting joints are accessible for repair. Polyethylene shall be installed between the fitting and concrete to provide as a bond break.

SAN ANTONIO WATER COMPANY SPECIAL PROVISIONS

SECTION 8 “CLEANING AND DISINFECTION OF WATER MAINS”

8.01 GENERAL

Disinfection of water mains applies to all construction involving *domestic* pipelines. The proposed water lines are surface water pipelines. Disinfection of these pipelines is not required.

8-03 FLUSHING OF WATER MAINS

Following the period of retention, testing water shall be thoroughly flushed from the line until the replacement water throughout the length of the pipeline is comparable in quality to the water served the public for the existing system. The Owner may take the necessary samples for bacteriological tests in accordance with the State Department of Public Health Standards.

Care shall be taken that the water is flushed from the line at its extremities and that the services are free of chlorinated water before being placed in service.

The chlorinated water may be used later for the testing of other lines, or if not so used, shall be disposed of by the Contractor. The Company will not be responsible for loss or damage resulting from such disposal. When a hypochlorite solution has been used for disinfecting the main, the flushing shall be in a direction opposite to that from which the line was filled.

The Contractor shall furnish all equipment in good operating condition, labor, material, and water necessary for flushing the pipeline.

SECTION 9 “HYDROSTATIC TESTING & LEAKAGE ALLOWANCE”

9.01 GENERAL

Hydrostatic and leakage test specifications apply to all construction involving pipelines, whether it is a main construction, booster plant piping, or reservoir piping, excepting reservoir drain lines.

The required test pressures shall be applied by a pump connected to the pipe in a manner satisfactory to the Engineer. The Contractor shall provide calibrated meters for measurement of the leakage, necessary bulkhead, piping, gauges, pumps, power, and labor, and perform and furnish everything necessary for making all tests required, at his own expense and shall furnish to the Engineer copies of all tests performed.

The Contractor, at his own expense, shall do all excavation necessary to locate and repair leaks or other defects which may develop under test, including removal of backfill already placed, and shall replace such excavated material and shall make all repairs necessary to the required water tightness, after which the required tests shall be repeated until the pipe and fittings meet the requirements set forth herein.

9-02 HYDROSTATIC TESTING

Upon completion of the laying, joining, backfilling and compacting of backfill, and at least seven days after the last concrete thrust device has been placed, the pipe and fittings involved in the construction shall be filled with water for a minimum of 24 hours. Care shall be taken to see that all air vents are open during the filling, and after the section has been completely filled, it shall be allowed to stand under a light pressure for a sufficient length of time to allow any cement mortar lining to absorb and to allow the escape of air from any air pockets. During this period, all fittings and connections shall be examined for leaks. If any are found, they shall be stopped. A test pressure 50% greater than the class of pipe and fittings shall then be applied to sections and maintained for a four-hour period. Test sections will be chosen which give, as nearly as possible, constant pressure throughout the section with the pressure being measured at

**SAN ANTONIO WATER COMPANY
SPECIAL PROVISIONS**

the lowest point. Any noticeable leaks shall be stopped, and any defective pipe shall be replaced with new sections.

The test shall be made prior to connecting the new line with the existing Company's pipes and mains. The test shall further be conducted with the open ends of pipes, valves, and fittings suitably closed. Valves shall be operated during the test period.

The test shall be conducted in the following manner. All air shall be expelled from the pipe. To accomplish this, if air valves, hydrants, or other outlets are not available, taps shall be made at the high points to expel the air, and these taps shall be tightly plugged afterwards. The pressure in the pipeline shall then be pumped up to the specified test pressure. When the test pressure has been reached, pumping shall be discontinued until the pressure in the line has dropped 5 psi, at which time the pressure shall again be pumped up to the specified test pressure. This procedure shall be repeated until four hours have elapsed from the time the specified test pressure was first applied. At the end of the four-hour test period, the pressure shall be pumped up to the test pressure for the last time.

Contractor shall provide at his own expense, the installation and material for all temporary blow-offs.

9.03 LEAKAGE ALLOWANCE

The leakage allowance shall be in accordance with the latest revision of AWWA C-600. The leakage shall be considered, as the total amount of water pumped into the pipeline during the four-hour period including the amount required in reaching the test pressure for the final time. Leakage shall not exceed the rate of 11.65 gallons per inch of diameter per mile of pipe per 24 hours. Any noticeable leak shall be stopped, and all defective pipe, fittings, valves, and other accessories discovered in consequence of the test, shall be removed and replaced by the Contractor with sound material and the test shall be repeated until the total leakage during a test of two hours duration does not exceed the rate specified below. The following table indicates the leakage allowance for various sizes of pipe and is equal to the number of gallons per hour test per 1,000 feet of pipe being tested.

Disinfection of water mains applies to all construction involving *domestic* pipelines. After the pipelines have been cleaned and tested, but before they have been connected to the existing system, disinfection shall be accomplished. In the event groundwater is encountered and it is impossible to prevent its entrance into the mains, or the mains are not free from dirt, they shall be thoroughly flushed prior to disinfecting. During the chlorinating process, all valves and facilities shall be operated. All water mains, water services, attached appurtenances, and connections if any shall be disinfected in accordance with the latest revision of AWWA C601 and as specified herein.

**ALLOWABLE LEAKAGE
STEEL & DIP PER 1000 FEET OF PIPELINE*
(GALLONS PER HOUR)**

Pipe Test Pressure at Lowest Point in Line (psig)

Avg. Test Pressure (psi)	NOMINAL PIPE DIAMETER / INCHES										
	3	4	6	8	10	12	14	16	18	20	24
450	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82
400	2.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99
250	0.36	.047	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70

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200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80

* **If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.**

**SECTION 10
"PERMIT FORMS"**



City of Upland Public Works
Land Development and Transportation Division

PERMIT APPLICATION
TEMPORARY STREET AND LANE CLOSURES

NOTE: Please allow a minimum of 8 working days to process the permit application. For pre-construction meetings, please email PWINSPECTIONS@CI.UPLAND.CA.US.

Start Date: Completion Date:

Location:

Description of Street / Lane Closure:

Contact Name: Project Number:

Company Name: E-mail Address:

Address: Daytime Phone:

City, State, Zip: Emergency Phone:

Traffic Control Plans (check all that apply):

- Latest edition of WATCH manual plan/sketch
Latest edition of CATTCH manual plan/sketch
Engineered Traffic Control Plans (TCP)

Table with Fees: Full Closure \$450.00, Partial Closure \$450.00, Block Party \$40.00, Vzn/TW/SCE/Gas - WO#, Traffic Control Plan Check (per fee schedule)

ALL APPLICATIONS MUST CONTAIN THE FOLLOWING INFORMATION. FAILURE TO PROVIDE THE INFORMATION WILL RENDER THE APPLICATION INCOMPLETE AND WILL NOT BE PROCESSED BY CITY STAFF.

- 1. Proof of valid California contractor's license
2. Proof of valid City Business license
3. Certificate of Liability Insurance (min. \$1M, with City named as additionally insured)
4. Proof of Workers Compensation
5. Any applicable fees
6. Site plan
7. City Project Number (if applicable)

I agree to all terms, conditions and restrictions listed on the back of the application.

Print Name Signature Date

FOR CITY STAFF USE ONLY:

Form containing fields for Permit, Effective Date(s), Work Hours, Permit Number, Closure Type, Permit issued by City of Upland, Receipt Number, Amount Paid, CIP or Project #, Extended Date(s), By, Date Extended, Permittee to contact City, Contacted By, Date of Call, and Distribution checkboxes.

Traffic Control Plans:

Work Area Traffic Control Handbook (WATCH) or California Temporary Traffic Control Handbook (CATTCH) – It is the responsibility of the applicant to present the City with a reasonable assessment of how the required work zone and existing field condition fits this category. The existing field condition/lane geometry must match the proposed drawing being referenced in the source document.

Engineered Traffic Control Plans (sign and stamped by a registered Traffic Engineer) – For major projects or projects affecting major arterials and/or intersections involving temporary traffic control beyond the scope of WATCH or CATTCH, an engineered traffic control plan will be required. Final determination of this requirement is made by traffic engineering staff. Engineered plans shall be stamped and signed by a registered civil traffic engineer. Allow two weeks for review of the first plan check submittal and one week for review of subsequent submittals of engineered traffic control plans.

General Notes

The Contractor shall provide and install barricades, delineators, warning devices, and construction signs in accordance with the latest edition of California Manual on Uniform Traffic Control Devices (M.U.T.C.D.). During adverse weather or unusual traffic or working conditions, additional traffic devices shall be placed as directed by the Public Works Director or Authorized Representative.

The Contractor shall relocate, preserve, and maintain the visibility of all existing signs within the project limits, which affect the flow of traffic, as directed by the Public Works Director or Authorized Representative. The Contractor at his expense as directed by the Public Works Director or Authorized Representative shall replace any signs, which are damaged or found to be missing during the course of construction.

The City of Upland and its elected officials, officers, agents, and employees shall not be answerable or accountable in any manner of any loss or damage that may happen to the work or any part thereof, or for any of the materials or other things used or employed in performing the work, or for injury or damage to any person or persons, either workmen, employees or Contractor or his Sub-Contractors or the public, or for damage to adjoining or other property from any cause whatsoever arising out of or in connection with the performance of the work. The Contractor shall be responsible for any damage or injury to any person or property resulting from defects or obstructions or from any cause whatsoever, except the sole negligence or willful misconduct of City, its employees, servants, or independent Contractors who are directly responsible to City during the progress of the work or at any time before its completion and final acceptance.

The Contractor will indemnify City and its elected officials, officers, agents, and employees against and will hold and save harmless from any and all actions, claims, damages to persons or property, penalties, obligations, or liabilities that may be asserted or claimed by any person, firm, entity, corporation, political subdivision, or other organizations arising out of or in connection with the work, operation, or activities of the Contractor, his agents, employees, Sub-Contractors, or invitees provided for herein whether or not there is concurrent passive or active negligence on the part of the City, its elected officials, officers, agents, and employees, but excluding such actions, claims, damages to persons or property, penalties, obligations, or liabilities arising from the sole negligence or willful misconduct of the City, its employees, servants, or independent Contractors who are directly responsible to City, and in connection therewith: The Contractor will defend any action or actions filed in connection with any of said claims, damages, penalties, obligations or liabilities and will pay all costs and expenses, including attorney's fees incurred in connection therewith.

Conditions

- Prior to the start of the temporary street closure, the applicant is required to notify and receive City approval a minimum of 72 permit business hours in advance (909) 931-4137. Permit business hours are M-Th from 8:00 AM to 5:00 PM.
- **Pre-cons are required.** Please contact Inspection at PWINSPECTIONS@CI.UPLAND.CA.US for Pre-Con.
- All signs shall be graffiti free and monitored/replaced when damaged.
- Must use flashing arrow boards for lane closures on all streets except for local/residential streets.
- Must backfill or steel plate all trenches during non-working hours.
- Post-temporary "NO PARKING" signs in the vicinity of the work area a minimum of 48 hours prior to closure. Signs shall clearly state effective dates and time of parking restriction.
- Must maintain one (1) lane of traffic in each direction at all times (Min. 12' wide lane).
- Protect any traffic signal detection equipment in-place or restore any equipment damaged by the Permittee within five (5) working days.
- Must maintain access for emergency vehicles to all driveways.
- Must notify all affected residents by letter or door hanger of the street closure a minimum of 48 hours in advance.
- When work is within a school zone, all sidewalks and traffic lanes shall remain open during non-working hours.
- Discretion per City Engineer or Inspector to change Traffic Control.

Restrictions/Comments: _____



Finance Stamp Here

Construction Permit No. _____

Street/Lane Closure Permit No: _____

PUBLIC WORKS INSPECTOR SIGN/DATE @ PRECON: _____

(VALID ONLY W/ PRECON INSPECTOR SIGN/DATE)

Final Inspection By: _____

NOTE TO PERMITTEES: ANY WORK NOT LISTED ON THE CITY'S ACTIVE CONSTRUCTION MONITORING LIST, WILL BE SHUT DOWN IMMEDIATELY. PERMIT HOURS 7:00 AM TO 3:30 PM (M-F)

This Permit is not valid without the following items completed.

- Pre-Construction Meeting is MANDATORY. Email PWINSPECTIONS@CI.UPLAND.CA.US to schedule pre-construction meeting for each permit. WORK SHALL NOT COMMENCE UNTIL THE PRE-CON MEETING HAS TAKEN PLACE. PRE-CONSTRUCTION MEETINGS MAY BE SCHEDULED FROM THE PERMIT ISSUANCE DATE; PRE-CON MEETING WILL BE HELD AT 3 DAYS (MIN.) AFTER REQUEST. Permittee will receive email response within 24 hours.
A 'Temporary Street Closure Permit' is required. No Street shall be closed and vehicular traffic or pedestrian access impeded in any way without said permit, please allow 4 to 8 City business days for permit processing. Please contact the Permit Engineer at PWPERMITS@CI.UPLAND.CA.US for permit information.
A 'Truck Access Plan' is required before the work begins; please contact the Permit Engineer at PWPERMITS@CI.UPLAND.CA.US for necessary information to complete the Access Plan.
'At Risk Improvements' applies to Contractors requesting to work in the Public Right-Of-Way without approved plans. The Developer/Contractor is proceeding at their own risk in commencing this work without City Approved Plans. The Developer/Contractor has supplied the appropriate bonding and Indemnity Letter.
Underground Service Alert at 1-800-227-2600 shall be notified by applicant at least 2 working days in advance of any excavation and an Underground Service Alert Inquiry Identification Number shall be obtained from Underground Service Alert. CONTACTING U.S.A. DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR LOCATING OR PROTECTING EXISTING UTILITIES.

Reference (Tract, P.M., S.P., C.U.P., or Address): _____

General Location/City Plan#/Project #: _____

Contact Name: _____ E-mail Address: _____

Contractor: _____ Telephone: _____

License Number: _____ Expiration Date: _____

Address: _____

Developer (Owner): _____ Telephone: _____

Address: _____

Applicant's Statement

The undersigned hereby applies for permission to undertake, or to have undertaken, construction work within public right-of-way in the City of Upland. Said undersigned has read the conditions provided as Supplemental Permit Information. Said undersigned hereby agrees to observe and comply with all permit provisions. All applicable Sections of the Upland Municipal Code and all applicable Sections of the City of Upland Standard Specification for Public Works Construction, and to complete said construction work all in accordance with the approved plan, and/or standard drawing and/or engineering directives and/or special conditions.

Applicant's Printed Name Signature Date Signed

This Permit Expires on: _____ Extension _____ Approved By _____

Permit Approval: _____ City Engineer or Authorized Representative Date

Items to be constructed or activities with this Permit

- | | | | |
|--|--|--|---|
| <p>Street</p> <ul style="list-style-type: none"> <input type="checkbox"/> AC Paving <input type="checkbox"/> Curb & Gutter <input type="checkbox"/> Drive Approach <input type="checkbox"/> Sidewalk <input type="checkbox"/> Miscellaneous Items <input type="checkbox"/> Per Attached Plans | <p>Sewer</p> <ul style="list-style-type: none"> <input type="checkbox"/> Sewer Main <input type="checkbox"/> Manhole <input type="checkbox"/> Sewer Lateral
Paid with Receipt Number | <p>Water</p> <ul style="list-style-type: none"> <input type="checkbox"/> Water Main <input type="checkbox"/> Water Lateral <input type="checkbox"/> Fire Hydrant <p>Storm drain</p> <ul style="list-style-type: none"> <input type="checkbox"/> Storm drain Main | <p>Miscellaneous</p> <ul style="list-style-type: none"> <input type="checkbox"/> Pole Replacement <input type="checkbox"/> Vault Inspection <input type="checkbox"/> Utility Trench / Pot Hole <input type="checkbox"/> Splice Pit <input type="checkbox"/> Aerial Work <input type="checkbox"/> Traffic Control Inspection <input type="checkbox"/> Grading <input type="checkbox"/> Stockpile/Material Placement <input type="checkbox"/> Square Feet Soil Disturbed _____ <input type="checkbox"/> Parkway Landscaping <input type="checkbox"/> Pavement Repairs |
|--|--|--|---|

Fees

Account Number

Permit Fee: _____

1010000-4205

Inspection Deposit: _____

1010000-4645

Total Due this Permit: _____

NO WORK ON WEEKENDS AND HOLIDAYS ALLOWED BY THIS PERMIT

Permit Work Hours

Permit work hours are from **7:00 AM to 3:30 PM**, Monday through Friday (excluding holidays). Any work after 3:30 PM is subject to the overtime inspection rate. Any work outside of the permit hours must be submitted in writing a minimum of four (4) business days/permit hours in advance

PERMIT IS VALID ONLY WITHIN CITY RIGHT-OF-WAY. WORKS ON PRIVATE PROPERTIES NEED OWNER'S PERMISSION/CONSENT. ALL PERTINENT ORDINANCES APPLY. PAVING WORKS MUST BE COMPLETED WITHIN 30 DAYS FROM BACKFILL IF INCLUDED IN SCOPE OF WORKS AND MUST FOLLOW ORDINANCE 1841.

Temporary Street Closure

Temporary Street Closures require a separate permit and a minimum of 4 to 8 permit business days for processing. Prior to the start of any temporary street and/or lane closure, the applicant is required to notify and receive City approval a minimum of 72 permit business hours in advance. Permit business hours are Monday through Thursday from 8:00 AM to 5:00 PM.

Permit Fee Structure

The minimum fee for a Construction Permit is \$325.00 and is non-refundable. This minimum fee is for minor construction usually for a utility tie-in for a single-family home. Projects that are more extensive require a review on a case-by-case basis.

Public Works Inspection Deposit (Defined)

Inspections are based on an hourly rate. Staff performs an audit when the Inspector final a Construction Permit. This audit consists of deducting the Inspector's documented time (shown on their time sheet) from the deposit.

Permit Extensions

Each permit extension will be assessed a new processing fee. The minimum fee is \$190.00 for each extension. Extension fees will automatically be assessed until the Permittee provides written notification to the City that the construction and all associated activities have been completed and that the permit has been finalized/signed-off by the Public Works Inspector.

Additional Comments: _____

MATERIALS SECTION

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SECTION 3 STEEL PIPE	MAT-2
SECTION 4 TYPES OF JOINTS	MAT-4
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SAN ANTONIO WATER COMPANY MATERIALS

SECTION 1 “CONTROL OF MATERIALS”

1.01 SAMPLES AND TESTS (Not Applicable)

1.02 DEFECTIVE MATERIALS

All materials not conforming to these Specifications shall be considered defective, and all such materials whether in place or not, shall be rejected and shall be removed immediately from the site of the work unless otherwise permitted by the Agency. No rejected material, the defects of which have been subsequently corrected, shall be used until approved in writing by the Agency.

SECTION 2 “PORTLAND CEMENT CONCRETE REINFORCING”

2.01 GENERAL AND CLASSES

All Portland Cement Concrete shall conform to the provisions of Section 201 of the Standard Specifications for Public Works Construction, latest edition, except as herein modified. The cement aggregate content for the various classes of concrete shall be as specified in Subsection 201-1.1.2 of the aforementioned Standards.

2.02 CEMENT

Portland Cement, including Portland Cement used in pre-cast products, shall be Type II or Type V, conforming to ASTM C150.

2.03 PORTLAND CEMENT

Portland Cement Concrete shall be composed of Portland Cement, fine aggregate, coarse aggregate, and water proportioned and mixed to produce a smooth dense workable mixture. It can be of the ready-mix variety as produced by any reliable ready-mix concrete firm.

2.04 REINFORCING STEEL

Reinforcing steel shall be deformed bars from new billet stock or intermediate grade conforming to the requirements of the latest revision of ASTM A15 and A305 and shall be of the required sizes and shapes and placed where shown on the Drawings or prescribed by the Company. The reinforcement shall be so secured in portion that it will not be displaced during the depositing of concrete. All reinforcing steel shall be completely encased in concrete. Wire mesh shall conform to ASTM A185. All bars shall be bent cold and at the time of concrete placement. They shall be free from rust, scale, oil, or any other coating which would reduce or destroy the bond between concrete and steel.

2.05 PRECAST CONCRETE VAULT STRUCTURES (Not Applicable)

2.06 AGGREGATE FOR USE IN CONCRETE

All aggregates for use in concrete shall conform to the requirements as set forth in the Standard Specifications for Public Works Construction, Subsection 200-1. Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of slump and water content in Subsections 201-1.1.2 and 201-1.3.3 of the Standard Specifications for Public Works Construction, latest edition.

SAN ANTONIO WATER COMPANY MATERIALS

SECTION 3 "STEEL PIPE"

3.01 STEEL PIPE

Steel pipe and fittings shall be manufactured in accordance with AWWA C-200 except as further noted in these specifications. Thickness of steel plate shall be as determined by the formula specified in AWWA C-200 but not less than 10-gauge nominal. The pipe shall be rated for 150 pound per square inch working pressure.

- a. Pipe – Pipe shall consist of the following component parts: a welded sheet steel or plate steel cylinder with joints formed integrally with the steel cylinder or with steel joints rings welded to the ends; a dense cement-mortar lining; a dense-cement mortar coated exterior or a tape coating system, as specified; a self centering bell and spigot joint with a circular pre-formed rubber gasket, so designed that the joint will be watertight under all conditions of service or welded lap joints, or plain end as required.
- b. Steel for cylinders – The steel for cylinders shall be hot-rolled low carbon steel sheets conforming to ASTM A283, Class B or C or A570, Class C. The minimum acceptable yield strength of the steel shall be 33,000 psi. Design stress shall not exceed 15,000 psi in any case. Type II cement shall be used for all mortar linings and coatings.
- c. Interior of Pipe – Where indicated on plans, steel pipe and fittings shall be cement mortar lined and cement mortar coated (coating required for pipes below grade) in accordance with the requirements of *"Cement Mortar Protective Lining and Coating for Steel Water Pipe - 4 inch and Larger - Shop Applied"* (AWWA C205).
- d. Exterior of Pipe (buried) – The exterior of pipe shall be a prefabricated, cold-applied tape coating system in accordance with AWWA C214 or cement mortar coating in accordance with AWWA C205.
- e. Field painting – Exposed pipe surface shall be prepared to receive paint by scraping and wire brushing and shall be painted with one (1) coat of surface primer and two (2) coats of finish paint. The paint shall be Chex-Rust Primer and Devthane 379 UVA enamel. Color: Sage Green or Desert Tan.
as manufactured by Devco Coatings company; or approved equal paint system using compatible primer and finish supplied by one manufacturer.
- f. portions of steel pipe shall
- g. Bell and Spigot Joints – Bell and spigot joints shall be made with rubber gaskets restrained or confined to an annular space in such manner that movement of the pipe or hydrostatic pressure cannot displace the gasket. Spigot and bell ends shall be formed by cold rolling or swaging or hot die and mandrel process. The deformation of the gasket in the joints of the installed pipe shall not exceed 45 percent nor less than 20 percent of the stretched gasket diameter.
- h. Welded Field Joints – Welded field joints shall meet the requirement of AWWA C206.
- i. Flange Joints – Flanged joints shall meet the requirement of AWWA C207. Steel slip-on and welding-neck flanges for flanged joints, where required, shall be 150-pound forged steel flanged conforming to ANSI B16.5, or they may be steel plate ring flanges conforming to AWWA C207, Class D with hubs omitted. Blind flanges shall also conform to the foregoing. Flanges shall be flat faced, suitable for use with full-face gaskets. Faces of flanges shall have a serrated finish of approximately 32 serrations per inch and approximately 1/64 inch deep. Serrations may be either spiral or concentric. Slip-on flanges conforming to ANSI B16.5 may be faced prior to welding to the pipe or fitting to which they are attached, provided that care is exercised in the welding process to prevent warping of the flanges. Final machining of the contact faces of slip-on flanges conforming to AWWA C207 shall be performed after the flange has been welded to the pipe. Flanges shall be attached to the pipe and fittings and installation of the pipe and fittings shall be such that the boltholes straddle the vertical axis of the pipe.

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Flange gaskets shall be ring types. Thickness shall be 1/16 for pipe 18-inches and smaller, and 1/8-inch for larger pipe. Flange assembly bolts shall be standard hexagon head machine bolts with heavy hot-pressed hexagon nuts. Threads shall conform to ANSI B1.1, coarse thread series, Class 2 fit. Bolt length shall be such that after the joints are made up, the bolts shall protrude through the nut, but not more than ½ inch. Flanges on steel pipe shall be welded to the pipe in accordance with AWWA C207.

Approved Manufacturer:

1. Northwest Pipe Company
 2. West Coast Pipe Linings
 3. Or equal
- j. Diameters – Diameters shown for steel pipe and larger than 12-inches indicate required inside diameter after lining. Steel pipe 12-inches in diameter and smaller shall be standard mill diameters.
- k. Special Fittings
- 1) Wherever pipeline has a bend exceeding the allowable deflection, a special fitting is required. The special fitting shall be fabricated in accordance with this Section. Specials shall extend a minimum distance back from the last weld equal to ½ the diameter of the pipe, but not less than 12 inches. The Contractor shall furnish and install specially fabricated specials and bends for closures, curves, bends, reducers, and connections to valves. The specials and bends shall have a minimum design equal to the adjoining pipe. Steel plates used in the fabrication shall conform to ASTM A283, Grade B or C, and shall not be stressed more than 13,500 psi at the design pressure. Fittings shall conform to applicable sections of AWWA C208 and C206. The minimum wall thickness of all specials shall be 0.1875 inches unless otherwise noted.
 - 2) All piping specials shall have a minimum wall thickness of the largest class pipe, which it joins. Wire reinforcement, either Spiral Wire Reinforcement or Wire Fabric Reinforcement shall conform to either ASTM A82 or A185. Fabric shall be sufficiently lapped to secure the full strength of the mesh.
 - 3) Ends of fittings shall be compatible with the pipe to which they connect.
- l. Testing – Testing of fittings shall be dye penetrant method. All testing shall be certified by the manufacturer and shall be stamped with legible identification.
- m. Bends – Unless otherwise indicated, bends shall have minimum centerline radius of 2-1/3 times its diameter. The maximum deflection at a metered girth seam shall be 22-1/2 degrees.
- n. Outlets – Collars wrappers on outlets shall have a minimum thickness determined by the following:
- $$T = \frac{P \times D_p \times D_o}{36,000 \times W}$$
- Whereas,
T=Thickness of collar or wrapper in inches
P=Design pressure in pounds per square inch Dp=Inside diameter of pipe cylinder, in inches
Do=Diameter of opening (major axis in ellipse), in inches
W=Width of collar or wrapper in inches

The width of the collars or wrappers shall be not less than 1/3 or more than ½ the inside diameter of the outlet, measured on the surface of the cylinder. Where specifically called for in lieu of collars or wrappers, crotch plates may be used on outlets larger than 12 inches in diameter. The design of crotch plates shall be based on AWWA Manual No. 11.

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- o. Long Radius Curves – Horizontal and vertical long radius curves may be formed of straight pipe by taking small angular deflections at the bell and spigot joints, not exceeding the published allowable deflections.
- p. Rubber Gaskets – The gaskets for joints shall be circular, free from imperfections, dense, and consist of first grade natural rubber or synthetic rubber, or a suitable combination of both. Baskets shall conform to the following physical requirements when tested in accordance with Federal Test Methods Standard No. 601.

Tensile Strength, Natural Rubber	2,700 psi
Tensile Strength, Synthetic Rubber	2,300 psi
Elongation at Rupture, Minimum	4.75%
Specific Gravity	1.15 to 1.25
Compression Set Test, Maximum	15%
Shore Durometer, Type A	50 –60
Tensile Strength After Aging, Minimum of Original	80%

- q. Markings – The following shall be clearly stenciled on each pipe section:
 - Class.
 - Internal diameter in inches.
 - Name of manufacturer.
 - Date of manufacture.
- r. Drawings – Prior to the manufacture of any pipe, the Contractor shall submit for approval detailed drawings of the pipe layout, including the required pull at each pipe joint which may be necessary to construct the pipeline in accordance with the drawings.
- s. Protection of Buried Couplings – Buried couplings and adjacent portions of buried steel pipe not having the pipe manufacturer’s cement mortar coating, shall be protected against corrosion by the mortar and diaper method. The diaper shall be made of Typar or other suitable fabric with porosity low enough to prevent the loss of cement from the grout. The fabric shall be hemmed on each edge, with a steel wire or strap contained within each hem. The hemmed diaper fabric shall be of length and width as recommended by the diaper manufacturer for the intended application.

Approved Manufacturer’s:

- 1. Mar-Mac Manufacturing Co.
- 2. or approved equal

SECTION 4 “JOINTS, FLANGES, BOLTS, AND GASKETS”

4.01 TYPE OF JOINTS

The joints shall be as specified on the Drawings and detailed therein.

4.02 FITTINGS FOR DUCTILE IRON

Fittings shall be cast iron (gray or ductile) in accordance to the applicable requirements of AWWA Standard C110 (ANSI A21.10). The ends of the fittings shall be push-on, rubber gasketed type, mechanical or flanged joints, as required or shown on the Drawings. Restraint joint fittings shall be used when shown on the Drawings and shall be in accordance with AWWA Standard C110 (ANSI A21.10). Fittings shall be “TR-Flex” as manufactured by U.S. Pipe, or equal. Restraint push-on joints for pipe and fittings shall be rated for a water working pressure of not less than 350 psi.

4.03 FLANGES

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Unless otherwise indicated on the Drawings, all cast iron fittings with flanged ends shall comply with the latest version of ANSI B16.1, "Cast Iron Pipe Flanges and Flanged Fittings, Class 125".

The gasket surface shall have a serrated finish of approximately sixteen serrations per inch, approximately 1/32 inch deep, with serrations in either a concentric or spiral pattern. In addition, all flanges shall meet the following tolerances:

Bolt circle drilling	(plus or minus)	1/16 inch
Bolt hole spacing	(plus or minus)	1/32 inch
Eccentricity of bolt circle and facing (with respect to bore)		1/32 inch maximum

Approved manufacturers:

1. Tyler
2. Union Foundry

4.04 GASKET MATERIAL FOR FLANGES

Gaskets for flanged joints shall be made of asbestos composition sheet packing, graphitized on both sides, 1/16 inch in thickness. Gaskets shall be of a quality equal to Crane Company, Granite, Johns Manville 60 Asbestos, or Garlock 7071.

4.05 BOLTS AND STUDS FOR FLANGED FITTINGS

Bolts and studs shall be cadmium plated and shall conform to ASTM A307, Grade B, "Steel Machine Bolts and Nuts and Tap Holes", when a ring gasket is used and shall conform to either ASTM A261, "Heat Treated Carbon Steel Bolting Material", or ASTM A193, "Alloy Steel Bolting Material for High Temperature Service", when a full-face gasket is used.

Bolts and nuts shall be heavy hexagon series. Nuts shall conform to ASTM A194, "Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service", either in Grade 1,2 or 2H. The fit shall be ANSI B1.1, "Unified Screw Threads", Class 2, except that Class 3 fit shall be used in holes tapped for studs. Threads may be made by either cutting or cold forming. Between 1/4 inch and 3/8 inch shall project through the nut when drawn tight.

4.06 COUPLINGS

Flex coupling, center and end rings shall be ductile iron and shall conform to ASTM A536 Grade 65-45-12. Gaskets shall be virgin SBR compounded for water and sewer service and conform to ASTM alloy steel for AWWA C-111-64 specifications.

Flex couplings are to be used as called out per plan on steel tie-ins only.

Approved manufacturers:

1. Romac 501 series only (no substitute)

SECTION 5 "PLASTIC PIPE"

5.0 PLASTIC PIPE

5.01 THE REQUIREMENT:

- A. The Contractor shall furnish and install all PVC and polyethylene plastic pipe, fittings, transitions, connections and appurtenant work, complete and in accordance with the requirements of the Contract Documents. The Contractor has choice of pipe material shown in the drawings. Where pipe material is specifically called for in the drawings, Contractor shall use such pipe as specified.

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5.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. Earthwork. Section 02200
- B. Water Pipeline Testing. Section 15042

5.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Commercial Standards:

ASTM D 1784 and ASTM D 1785	Specifications for Polyvinyl Chloride (PVC) Plastic Pressure Pipe
ASTM D 3034	Specifications for Polyvinyl Chloride (PVC) Plastic Gravity Sewer Pipe
ASTM D 2321	Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

5.04 CONTRACTOR SUBMITTALS:

- A. Contractor shall submit copies of the manufacturer's product specifications according to the requirements of Section 01300 entitled, "Contractor Submittals".

PRODUCTS

5.05 PVC (POLYVINYL CHLORIDE) PRESSURE PIPE, 8-INCHES AND SMALLER, SOLVENT WELDED

- A. PVC pressure pipe 8-inches and smaller shall be made from all new rigid un-plasticized polyvinyl chloride and shall be Normal Impact Class 12454-B, Schedule 40, to conform to ASTM D 1785, unless otherwise shown. Elbows and tees shall be of the same material and schedule as the pipe. Unless otherwise shown, joint design shall be for solvent-welded construction. Pressure pipe shall be as follows:
- B. Pipe shall meet the requirements of AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 12-Inch with maximum DR of 18.
- C. Provisions must be made for expansion and contraction at each joint with an elastomeric seal.
- D. The bell shall consist of an integral thickened wall section with an elastomeric seal. The wall thickness in the bell section shall conform to the requirements of Section 6.2 of ASTM D3139, "Standard Specification for Joint for Plastic Pressure Pipes Using Flexible Elastomeric Seals."
- E. When used for potable water systems, pipe shall meet the requirements of ANSI/NSF 61 "Drinking Water System Components – Health Effects."
- F. The pipe shall be manufactured to cast iron outside diameters (CIOD) in accordance with AWWA C900.
- G. The seal shall meet the requirement of ASTM F477 "Standard for Elastomeric Seals (Gaskets) for Joining Plastic Pipe."

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5.06 DRAIN WASTE VENT PIPE (PVC DR35 ½" – 8")

- A. Pipe shall be schedule 40, extruded from PVC Compound having a minimum Cell Classification 12454B as defined in ASTM D 1784. Belled end shall conform to ASTM D 2672, "Joints for PVC Pipe Using Solvent Cements", and shall conform to ASTM D 2855.

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5.07 INSTALLATION OF PIPE:

- A. All pipe, fittings, etc. shall be carefully handled and protected against damage, impact shocks and free fall. All pipe handling equipment shall be acceptable to the Engineer. Pipe shall not be placed directly on rough ground, but shall be supported in a manner which will protect the pipe against injury whenever stored at the work site. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor.
- B. The Contractor shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Damaged pipe shall be replaced with new undamaged sections of pipe.
- C. Before placement of the pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the Work. As pipe laying progresses, the Contractor shall keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, rocks and any other debris following completion of pipe laying prior to testing, disinfecting and placing the completed pipeline in service.
- D. Pipe shall be laid directly on the imported bedding material. No blocking will be permitted and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Bell holes shall be formed at the ends of the pipe to prevent joint loading at the bells or couplings.
- E. Where necessary to raise or lower the pipe grade due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer.
- F. No pipe shall be installed upon a foundation into which frost has penetrated or any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. No pipe shall be laid unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.
- G. Immediately before jointing bell and spigot pipe, both the bell and spigot end of the pipe shall be thoroughly cleaned and lubricated with an approved vegetable-based lubricant. The spigot end of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper alignment. Tilting of the pipe to insert the spigot into the bell will not be permitted.
- H. Solvent-welded and heat-fused joints shall be carefully and thoroughly cleaned immediately before jointing the pipe. Particular care shall be taken in making solvent-welded joints to ensure a uniform, homogeneous and complete bond.

PAYMENT

Payment of the work in this section will be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

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END OF SECTION 02640

SECTION 6 RESILIENT WEDGE GATE VALVES

6.01 GENERAL

All valves shall be new and of current manufacture. Valves shall only be installed where specifically called for on the construction plans approved by the Agency.

The laying lengths and the end flanges of flanged valves shall conform in dimensions and drilling to ANSI B16.1 for Cast Iron Flanges and Flanged Fittings. Flanges of valves designed for a working pressure of 175 psi or less shall be faced and drilled to a 125-pound American Standard Dimension. Flanges of all valves designed for a working pressure of greater than 175 psi shall be faced and drilled to a 260-pound American Standard Dimension.

Push-on joints shall conform to the requirements of ANSI/AWWA C111/A21.11.

Each valve shall be tested under a test pressure equal to twice its design water working pressure.

The Contractor is to make a choice of an approved valve and then use it throughout the total project.

6.02 RESILIENT WEDGE GATE VALVES

Resilient wedge gate valves shall conform to the latest revision of AWWA C509, "Standard for Resilient Wedge Gate Valves for Ordinary Water Works Service". Resilient wedge gate valves shall be designed for a water working pressure of 200 psi and shall be iron bodied, non-rising stem opening to the left, and provided with two o-ring stem seals and a two-inch square operating nut. All interior parts of gate valves, except the gate, shall be constructed of bronze conforming to the requirements of ASTM B62. All ferrous parts of the valve, inside only except the gate, shall be coated with fusion-bonded epoxy in accordance with the latest revision of AWWA C-550. The gate shall be fully encapsulated in molded rubber conforming to the requirements of ASTM D2000. The manufacturer's name or symbol, the size of the valve, the year of manufacturer, and the working water pressure shall be cast in the bonnet or body of the valve. Each valve shall be tested to twice the working pressure. Valves shall be furnished with ends as specified on the plans or by the Inspector.

The interior of all valves shall be fusion-bonded epoxy-coated to a thickness of 6-8 mils of epoxy.

Approved types:

1. Mueller
2. American AVK
3. Clow
4. M & H

SECTION 7 "BUTTERFLY VALVES"

7.01 GENERAL

Butterfly valves shall be furnished and installed by the Contractor at the location and in accordance with the type of ends as shown on the Plans and as herein specified.

7.02 BUTTERFLY VALVES

All butterfly valves shall be tight closing, with rubber seats, which are recess mounted and securely fastened to the valve body or fastened to the disc. Valves shall be bubble tight at rated pressures and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve discs

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shall rotate 90 degrees from the fully open position to the tightly shut position. Valves shall meet the full structural requirements of the applicable classes of latest revision of AWWA C504. The manufacturer shall have manufactured tight closing rubber seated butterfly valves for a period of at least five years.

Valve bodies shall be constructed of cast iron ASTM A126, Class B. Flange drilling shall be in accordance with ANSI B16.1 Standard for cast iron flanges. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be strictly in accordance with the latest revision of AWWA 504. The interior of the valve body shall be fusion-bonded epoxy-coated with 8-10 mils of epoxy or factory applied thermosetting epoxy.

Shafts of all valves shall be turned, ground, and polished. Valve shafts shall be constructed of 18-8, Type 304 stainless steel or high tensile strength carbon steel, provided the shaft is sealed from the line contents and shall be a one-piece unit extending full size through the valve disc and valve bearings.

Valves shall be fitted with sleeve type bearings. Bearings shall be corrosion resistant and self-lubricating. Bearing load shall not exceed 2,500 psi.

Valve operators shall be designed to hold the valve in any intermediate position between fully opened and fully closed without creeping or fluttering. Valve operators shall be of the enclosed gear or screwed rod type manufactured specifically for buried service operation. Orientation of actuator shall be on left side of valve when viewed through valve from the flanged end. Valves shall open with a counterclockwise or left rotation of the operator nut. All butterfly valves shall have the minimum shutoff pressure rating of 150 psi.

Approved types:

1. Henry Pratt Company
5. Mueller
6. M&H

SECTION 8 "MISCELLANEOUS VALVES"

8.01 AIR RELEASE AND VACUUM VALVES

Valves shall be of the size shown and shall have flanged or screwed ends to match piping. Bodies shall be of high strength cast iron. The float, seat, and all moving parts shall be constructed of Type 18-8 stainless steel. Seat washers and gaskets shall be of material ensuring water tightness with a minimum of maintenance. Valves shall be designed for minimum 150-psi water-working pressure. Unless otherwise noted, valves shall be combination air release and vacuum valves.

Approved valves:

1. APCO/Bulletin 623, #143C (1") #145C (2")
2. Crispin
3. Golden-Anderson Valve Specialty Company
4. or approved equal

8.02 PRESSURE GAUGES

Unless otherwise shown, pressure gauges shall be plain case, bottom connection with bronze bourdon tube and bronze or stainless-steel movement. Gauge accuracy shall be plus or minus 1 percent of full scale. Range shall be shown. Dial size shall be 4-1/2 inches. Gauges shall be liquid filled with glycerin or silicone.

Gauge protectors shall be provided. Protectors shall be flanged diaphragms having a stainless-steel diaphragm and 1/2-inch connection.

Approved gauges:

1. Irrrometer

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SECTION 01000

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 Work Included

- A. Adopted Specifications and Drawings.

1.02 Referenced Standards

- A. In connection with contracts related to the subject "Bidder's Proposal", and except as otherwise provided below, all work shall be done in accordance with the provisions of the current edition of "STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION" (popularly known as the "GREENBOOK"), including Supplements, prepared and promulgated by the Southern California Chapter of the American Public Works Association and the Associated General Contractors of California, which Specification is hereinafter referred to as the Standard Specification. The provision of this Specification shall apply and/or shall supersede as the case may be, the above referenced Standard Specification.
- B. Standards listed as "Reference Standards" in the various sections of these contract documents are hereby incorporated into these specifications by reference.
- C. Referenced documents shall include all revisions, amendments, supplements, or addenda issued on or before the date of advertising for bids.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION 01000

SECTION 01015

MOBILIZATION

PART 1 – GENERAL

1.01 DESCRIPTION – This section describes mobilization, including the following:

- A. Organization and mobilization of Contractor's forces and equipment
- B. Transporting various tools, materials, and equipment to the site
- C. Erection of temporary buildings and facilities required for construction operations.

PART 2 – MATERIALS

- 2.01** Temporary facilities and other mobilization items are specified in the General and Special Provisions sections of the contract documents.
- 2.02** Mobilization shall also include bonding, insurance, financing, permits, security, storage areas, temporary utilities, sanitation facilities and general surveying.

PART 3 – EXECUTION

- 3.01** Mobilization shall include mobilization of all construction equipment, materials, supplies, appurtenances, and the like, manned and ready for commencing and prosecuting the work; and the subsequent demobilization and removal from the site of said equipment, appurtenances, and the like upon completion of the work.
- 3.02** Mobilization shall also include assembly and delivery to the site of plant, equipment, materials, and supplies necessary for the prosecution of work, but which are not intended to be incorporated in the work; the clearing of and preparation of the contractor's work area; the complete assembly, in working order, of equipment necessary to perform the required work; personnel services preparatory to commencing actual work; and all other preparatory work required to permit commencement of the actual work on construction items for which payment is provided under the Contract.
- 3.03** Upon completion and before making application for acceptance of the work, the contractor shall clean all rights-of-way, streets, and all other grounds occupied by him/her in connection with the work of all rubbish, excess materials, temporary structures, and equipment, and all parts of the work and grounds occupied by him shall be left in a neat and presentable condition. In the event the contractor fails to clean up as specified herein, clean up may be performed by the Agency at the contractor's expense.

PART 4 - PAYMENT

- 4.01** Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for mobilization and demobilization.
- 4.02** Fifty percent of the bid amount for mobilization and demobilization will be paid upon the contractor having mobilized the construction effort. Fifty percent of the bid amount for mobilization and demobilization will be paid upon demobilization and final cleanup by the contractor.

END OF SECTION 01015

SECTION 01045
EXISTING FACILITIES

PART 1 – GENERAL

1.01. Description

- A. This section includes requirements for connection to existing water and sewer facilities.

1.02. Related Work Specified Elsewhere

- A. Chlorination of Water Mains for Disinfection: 15041.
- B. Hydrostatic Testing of Pressure Pipelines: 15042.

1.03. Location

- A. The Contractor shall be responsible for determining in advance the location of all existing pipelines to which connections are to be made.
- B. The Contractor shall notify Underground Service Alert of Southern California (Dig Alert) at least two working days prior to construction at 811.

PART 2 – MATERIALS

All materials used in making the connection or removing the facility from service shall conform to the applicable sections of these specifications.

PART 3 – EXECUTION

3.01. Connection to Existing Water Lines

- A. Notification: The Contractor shall give the City a minimum of four (4) working days notice before the time of any proposed shutdown of existing mains or services.
- B. Notice to Proceed: Connections shall be made only in the presence of the City Representative and no connection work shall proceed until the City Representative has given notice to proceed.
- C. Material: The Contractor shall furnish all pipe and materials including as may be required: labor and equipment necessary to make the connections, all required excavation, backfill, pavement replacement, lights and barricades, water truck, highline hose, and fittings for making the connections. In addition, the Contractor shall assist the City in alleviating any hardship incurred during the shutdown for connections.
- D. Temporary Work: Where connections are made to existing valves, the Contractor shall furnish and install all temporary blocking, steel clamps, shackles, and anchors as required by the City Representative. Valve boxes and covers shall be replaced and adjusted to the proper grade.

- E. Dewatering: The Contractor shall dewater existing mains, as required, in the presence of the City Representative.
- F. Inadequate Progress: If progress is inadequate during the connection operations to complete the connection in the time specified, the City Representative shall order necessary corrective measures. All costs for corrective measures shall be paid by the Contractor.
- G. Connections: Connections shall be made with as little change as possible in the grade of new main.
 - 1. If the grade of the existing pipe is below that of the new pipeline, a sufficient length of the new line shall be deepened so as to prevent the creation of any high spot or abrupt changes in grade of the new line.
 - 2. Where the grade of the existing pipe is above that of the new pipeline, the new line shall be laid at specified depth, except for the first joint adjacent to the connection, which shall be deflected as necessary to meet the grade of the existing pipe.
 - 3. If sufficient change in direction cannot be obtained by the limited deflection of the first joint, a fitting of the proper angle shall be installed.
 - 4. Where the connection creates a high or low spot in the line, a standard air release or blow-off assembly shall be installed as directed by the City Representative.
- H. Testing: The new pipeline shall NOT be connected to an existing facility until the new pipeline has successfully passed all pressure and disinfection tests in accordance with Sections 15041 and 15042.

END OF SECTION 01045

SECTION 01300

CONTRACTOR SUBMITTALS

PART 1 – GENERAL

1.01. General

- A. Wherever submittals are required hereunder, all such submittals by the Contractor shall be submitted to the Engineer.
- B. Within 14 days after the date of commencement as stated in the Notice to Proceed, the Contractor shall submit the following items to the Engineer for review.
 - 1. A preliminary schedule of Shop Drawing, Sample, and proposed Substitutes "Or Equal" submittals.
 - 2. A list of all permits and licenses the Contractor shall obtain indicating the agency required to grant the permit and the expected date of submittal for the permit and required date for receipt of the permit.

1.02. Contractor's Schedule Submittal

- A. Time of Submittals: Within 14 days of the commencement date stated in the Notice to Proceed, the Contractor shall submit for acceptance by the Engineer, a preliminary construction schedule for the Work, showing its general plan for orderly completion of the Work and showing in detail its planned mobilization of plant and equipment, sequence of early operations, and timing of procurement of materials and equipment. The construction schedule produced and submitted shall indicate a project completion date on or before the contract completion date. The Engineer, within 14 days after receipt of the preliminary construction schedule, shall meet with a representative of the Contractor to review the preliminary plan construction schedule.
- B. Within 14 days after the conclusion of the Engineer's review period, the Contractor shall revise the preliminary construction schedule as required, and resubmit to the Engineer. The revised construction schedule shall be revised and/or accepted or rejected by the Engineer within 14 calendar days after receipt. The schedule, when accepted by the Engineer, shall constitute the Initial Construction Schedule until later revised schedules are submitted due to delays beyond the control and without the fault or negligence of the Contractor.
- C. Acceptance: When the Initial Construction Schedule has been accepted, the Contractor shall submit to the Engineer eight (8) copies of the accepted schedule.
- D. Additional Construction Schedules: The CONTRACTOR, if requested by the ENGINEER, shall provide a Revised Construction Schedule if, at any time, the ENGINEER considers the completion date to be in jeopardy because of any portion of the WORK falling behind schedule. The Revised Construction Schedule shall show how the CONTRACTOR intends to accomplish the WORK to meet the completion date. The form and method employed by the CONTRACTOR shall be the same as for the Initial Construction Schedule.
- E. Construction Schedule Revisions: The CONTRACTOR shall modify any portions of the construction schedule that becomes infeasible because of portions of the WORK falling behind schedule, or for any other valid reason. Any portion of the WORK that cannot be completed by its originally-scheduled completion date shall be deemed to be behind schedule.

1.03. Shop Drawings

- A. Wherever called for in the Terms and Conditions, Contract Documents, or where required by the City, the Contractor shall furnish to the City for review, 8 copies of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication, and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items. Whenever the Contractor is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state wherein the project is to be built, unless otherwise directed.
- B. Except as may otherwise be indicated herein, the City shall return prints of each submittal to the Contractor with its comments noted thereon, within 10 working days following their receipt by the City.
- C. If the submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.
- D. If the submittal is returned to the Contractor marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required.
- E. If the submittal is returned to the Contractor marked "AMEND-RESUBMIT," the Contractor shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the City.
- F. If the submittal is returned to the Contractor marked "REJECTED-RESUBMIT," the Contractor shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the City.
- G. Fabrication of an item shall commence only after the City has reviewed the pertinent submittals and returned copies to the Contractor marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.
- H. All Contractor shop drawings submittals shall be carefully reviewed by an authorized representative of the Contractor, prior to submission to the City. Each submittal shall be dated, signed, and certified by the Contractor, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the City of any Contractor submittals will be made for any items which have not been so certified by the Contractor. All non-certified submittals will be returned to the Contractor without action taken by the City, and any delays caused thereby shall be the total responsibility of the Contractor.
- I. The City's review of Contractor shop drawings submittals shall not relieve the Contractor of the entire responsibility for the correctness of details and dimensions. The Contractor shall assume all responsibility and risk for any misfits due to any errors in Contractor submittals. The Contractor shall be responsible for the dimensions and the design of adequate connections and details.

1.04. Proposed Substitutes or "Equal" Item Submittal

- A. Whenever materials or equipment are specified or described in the contract documents by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words "or equal" indicating that a substitution is permitted, materials or equipment of other

Suppliers may be accepted by the Engineer if sufficient information is submitted by the Contractor to allow the Engineer to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements.

1. The burden of proof as to the type, function, quality and of any such substitute material or equipment shall be upon the Contractor. Lower cost materials might not be approved by the engineer. Contractor may be required to supply the specified product at the suppliers cost.
2. The Engineer will be the sole judge as to the type, function, and quality of any such substitute material or equipment and the Engineer's decision shall be final.
3. The Engineer may require the Contractor to furnish at the Contractor's expense additional data about the proposed substitute.
4. The City may require the Contractor to furnish at the Contractor's expense a special performance guarantee or other surety with respect to any substitute.
5. Acceptance by the Engineer of a substitute item proposed by the Contractor shall not relieve the Contractor of any responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.
6. The Contractor shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the Contractor's work, the work of its subcontractors and of other contractors, and shall effect such changes without cost to the City.

B. The procedure for review by the Engineer will include the following:

1. If the Contractor wishes to furnish or use a substitute item of material or equipment, the Contractor shall make written application to the Engineer on the "Substitutions Request Form" for acceptance thereof.
2. Unless otherwise provided by law or authorized in writing by the Engineer the "Substitution Request Form(s)" shall be submitted within the 35 day period after award of the Contract.
3. Wherever a proposed substitute material or equivalent has not been submitted within said 35 day period, or wherever the submission of a proposed substitute material or equipment has been judged to be unacceptable by the Engineer, the Contractor shall provide the material or equipment named in the Contract Documents.
4. The Contractor shall certify that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified, and be suited to the same use as that specified.
5. The Engineer will be allowed a reasonable time within which to evaluate each proposed substitute.
6. As applicable, no shop drawing submittals will be made for a substitute item nor will any substitute item be ordered, installed, or utilized without the Engineer's prior written acceptance of the Contractor's "Substitution Request Form" which will be evidenced by a Change Order.
7. The Engineer will record the time required by the Engineer in evaluating substitutions proposed by the Contractor and in making changes in the Contract Documents occasioned thereby. Whether or not the Engineer accepts a proposed substitute, the Contractor shall reimburse the City for the charges of the Engineer for evaluating each proposed substitute.

- C. The Contractor's application using the "Substitution Request Forms" shall contain the following statements and/or information which shall be considered by the Engineer in evaluating the proposed substitution:
1. The evaluation and acceptance of the proposed substitute will not prejudice the Contractor's achievement of substantial completion on time.
 2. Whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents to adopt the design to the proposed substitute.
 3. Whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.
 4. All variations of the proposed substitute for that specified will be identified.
 5. Available maintenance, repair, and replacement service will be indicated.
 6. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims or other contractors affected by the resulting change.

1.05 Samples Submittal

- A. Whenever in the Specifications samples are required, the Contractor shall submit not less than 3 samples of each item or material to the Engineer.
- B. Samples, as required herein, shall be submitted for acceptance a minimum of 21 days prior to ordering such material for delivery to the jobsite, and shall be submitted in any orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the Work.
- C. All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and Manufacturer's name of identification and submitted to the Engineer for acceptance. Upon receiving acceptance of the Engineer, one set of the samples will be stamped and dated by the Engineer and returned to the Contractor, and one set of samples will be retained by the Engineer, and one set of samples shall remain at the job site until completion of the Work.
- D. Unless indicated otherwise, all colors and textures of specified items presented in sample submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines.

1.06. Technical Manual Submittal

- A. The Contractor shall furnish to the Engineer five (5) identical sets of technical manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A table of contents shall be provided which indicates all equipment in the technical manuals.
- B. Using the outline provided in the Equipment Maintenance Summary Sheet (copy of which may be obtained from the Engineer), the Contractor shall include in the technical manuals for each item of mechanical, electrical, and instrumentation equipment the following:
1. Complete operating instructions, including location of controls, special tools or other

equipment required, related instrumentation, and other equipment needed for operation.

2. Lubrication schedules, including the lubricant SAE grade and type, temperature range of lubricants, and including frequency of required lubrication.
 3. Preventative maintenance procedures and schedules.
 4. Parts lists, by generic title and identification number, complete, with exploded views of each assembly.
 5. Disassembly and reassembly instructions.
 6. Name and location of nearest supplier and spare parts warehouse.
 7. Recommended troubleshooting and start up procedures.
 8. Reproducible prints of the record drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these specifications.
 9. Tabulation of proper settings for all pressure relief valves, (low/high) pressure switches and other related equipment protection devices.
 10. Detailed test procedures to determine performance efficiency of equipment.
 11. List of all electrical relay settings including alarm and contact settings.
- C. All technical manuals shall be submitted in final form to the Engineer not later than the 75 percent of construction completion date. All discrepancies found by the Engineer in the technical manuals shall be corrected by the Contractor within 30 days from the date of written notification by the Engineer.

1.07. Spare Parts List Submittal

The Contractor shall furnish to the Engineer five (5) identical sets of spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the ~~current~~ list price of each spare part. The spare parts list shall be limited to those spare parts which each manufacturer recommends be maintained by the City in inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the City in ordering. The Contractor shall cross-reference all spare parts lists to the equipment numbers designed in the Contract Documents. The spare parts lists shall be bound in standard size, 3-ring, loose-leaf, vinyl plastic hard cover binders suitable for ~~bookshelf~~ storage. Binder ring size shall not exceed 2.5 inches.

1.08. Record Drawings Submittals

- A. The Contractor shall keep and maintain, at the job site, one record set of Drawings. On these, it shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the ~~course~~ of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. Said record drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master record drawings of the Contractor's representation of as-built conditions, including all revisions made necessary by addenda and change orders shall be maintained up to date during the progress of the Work.

- B. In the case of those drawings which depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the record drawings shall be updated by indicating those portions which are superseded by change order drawings or final shop drawings, and by including appropriate reference information describing the change orders by number and the shop drawings by manufacturer, drawing, and revision numbers.
- C. Record drawings shall be accessible to the Engineer and/or Inspector at all times during the construction period and shall be delivered to the Engineer upon completion of the Work.
- D. Upon substantial completion of the Work and prior to final acceptance, the Contractor shall complete and deliver a complete set of record drawings to the Engineer for transmittal to the City, conforming to the construction records of the Contractor. This set of drawings shall consist of corrected drawings showing the reported location of the Work. The information submitted by the Contractor and incorporated by the Engineer into the Record Drawings will be assumed to be reliable, and the Engineer will not be responsible for the accuracy of such information, nor for any errors or omissions which may appear on the Record Drawings as a result.

1.09. Sheeting, Shoring, Bracing, or Sloping Of Trenches Plan Submittal

- A. Prior to commencement of any excavation, 5 feet or greater in depth, the Contractor shall submit to the City a detailed plan showing the design of sheeting, shoring, bracing, sloping, or equivalent method and shall be in receipt of the City's acceptance of same, all as specified in Paragraph "Protection of Workers in Trench Excavations" of Section entitled "California State Requirements" of the Supplementary General Conditions.
- B. In accordance with California Code of Regulations, Title 8, Section 341 (Permit Requirements), the Contractor shall obtain a permit from the State of California Division of Industrial Safety prior to any trench excavation. A copy of said permit shall be kept at the job site and available to the City Representative upon request.

1.10. Storm Water Pollution Prevention Plan (SWPPP) Submittal

When so specified in the General Provisions, Special Provisions, Detail Specifications or Plans, or if so required by the California State Water Resources Control Board, the Contractor shall prepare and submit a storm water pollution prevention plan. The SWPPP shall conform to the requirements specified in the General Provisions, Special Provisions, Detail Specifications or Plans and those of the California State Water Resources Control Board. The Notice of Intent will be filed by the City.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION 01300

SECTION 01560

PROJECT ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 EXPLOSIVES AND BLASTING

- A. The use or storage of explosives on the Work shall be strictly prohibited at all times. No exceptions taken.

1.02 DUST ABATEMENT AND RUBBISH CONTROL

- A. The Contractor shall provide under the Contract all necessary measures to prevent its operation from producing dust in amounts damaging to property or causing a nuisance to Owner's plant personnel and operations or to persons living in or occupying buildings in the vicinity. The Contractor shall be responsible for damage resulting from any dust originating from its operations. The dust abatement measures shall be continued throughout the length of the contract.
- B. During the progress of the Work the Contractor shall keep the site of the Work and other areas used by it in a neat and clean condition and free from any accumulation of rubbish. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the Work site, and shall establish regular intervals of collection and disposal of such materials and waste. The Contractor shall also keep its haul roads free from dirt, rubbish and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal and in conformance with all applicable Safety Laws and Health Standards for Construction. Disposal of materials and tracking of disposal materials and recycled materials is required per the County of San Bernardino Solids Waste Management Plan. See requirements in back of specifications. The Owner's dumpster shall not be used by the Contractor.

1.03 SANITATION

- A. The Contractor shall provide approved fixed or portable chemical toilets wherever needed for its employees. The Contractor shall establish regular intervals of collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of in a manner satisfactory to the Engineer and in accordance with all laws and regulations pertaining thereto. The Owner's toilet facilities shall not be used by the Contractor.

1.04 CHEMICALS

- A. All chemicals used during project construction or furnished for project operation, whether soil sterilant, disinfectant, polymer, reactant or of other classification, shall show approval for use by either the U. S. Environmental Protection Agency or the U. S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

1.05 CULTURAL RESOURCES

- A. The Contractor's attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archeological or cultural resources (hereinafter called "cultural resources"). If potential cultural resources are discovered during subsurface excavations at the site of construction, the following procedures shall be instituted:
 - 1. The Contractor shall immediately notify the Engineer.

2. The Engineer will issue a Field Order directing the Contractor to cease all construction operations at the location of such potential cultural resources find.
 3. Such Field Order shall be effective until such time as an archeologist certified by the Society of Professional Architects examines the site, and can be called to assess the value of these potential cultural resources and make recommendations to the California State Historical Society Archeologist.
- B. If the archeologist determines that the potential find is a bona fide cultural resource, at the direction of the California State Historical Society Archeologist, the Contractor shall suspend work at the location of the find under the provisions for changes contained in Articles 13, 14 and 15 of the General Conditions.

1.06 NOT USED

1.07 NOISE

- A. All equipment operated on the site including air compressors shall be equipped with properly operated mufflers that meet the manufacturer's specifications.

1.08 STORM WATER

- A. The Contractor is required to adhere to the provisions of the Federal Clean Water Act as regulated by the U.S. Environmental Protection Agency in Code 40, Code of Federal Regulations (CFR) Parts 122, 123, 124, the Porter-Cologne Act (California Water Code), the Waste Discharge Requirements for Municipal Storm Water Discharges within the County of Los Angeles. Copies of suitable Best Management Practices (BMPs) from the California Storm Water Best Management Practice Handbook (CSWBMP) for Construction Activities are readily available. The Contractor shall select appropriate BMP's applicable to the subject work. All BMP's are subject to review by the Owner for compliance with the provisions of the Federal Clean Water. Contractor is required to prepare and submit a Storm Water Pollution Prevention Plan (SWPPP) to the governing agency by a certified SWPPP preparer where required by law. Reviewed and approved Erosion Control Plans are included in the project plan set
- B. Saw Cutting: Shovel or vacuum saw-cut slurry and remove from site. Downstream catch basins, storm drains and sewer manholes are to be barricaded or covered to contain slurry during saw cutting operations per BMP CA2 in the CSWBMP Handbook.
- C. Concrete Truck Washout: Washout of concrete trucks will not be allowed in the gutters, paved street or catch basins. Washout on the subgrade will be allowed only if the runoff from such a discharge can be contained and not be allowed to enter any catch basin, storm drain or sewer manhole per BMP CA23 in the CSWBMP Handbook.

END OF SECTION 01560

SECTION 01563

DIVERSION AND CONTROL OF WATER

PART 1 - GENERAL

1.01 DESCRIPTION

This section covers the control of surface water runoff, dewatering of pipeline trenches and structural excavations, and other elements required for control of water if the site conditions should dictate the need.

1.02 SUBMITTALS

Prior to the Contractor performing any excavation, the contractor shall review and implement the provisions of the reviewer and approved Erosion Control Plan included with the project plan set.

PART 2 - MATERIALS

Materials and equipment required for control of water shall be furnished and maintained by the Contractor, as required to perform the construction.

PART 3 - EXECUTION

- 3.01. Perform all permanent construction in area free from water.
- 3.02. The necessary machinery, appliances and equipment shall be provided and operated to keep excavations free from water during construction, and to dispose of the water so as not to cause injury to public or private property or to cause a nuisance or a menace to the public. Sufficient pumping equipment and machinery, in good working condition, shall be provided for all emergencies including power outage; and sufficient workmen shall be available at all times for the operation of the pumping equipment. The dewatering diversion systems shall not be shut down between shifts, on holidays or weekends, or during work stoppages without written permission from the Owner.
- 3.03. The control of groundwater shall be such that softening of the bottom of excavations, or formation of "quick" conditions or "boils" during excavation, shall be prevented. Dewatering diversion systems shall be designed and operated so as to prevent removal of the natural soils. Natural or compacted soils softened by saturation with groundwater or standing surface water shall be removed and replaced as instructed by the Owner's Representative at no additional expense to the Owner.
- 3.04. During excavation, construction of structures, installation of pipelines and sewers, placing of structural and trench backfill, and the placing and setting of concrete, excavations shall be kept free of water except as specified. Surface runoff shall be controlled so as to prevent entry or collection of water in excavations. The static water level shall be drawn a minimum of 1 foot below the bottom of the excavation, except 2 feet below the bottom of excavations for structures, so as to maintain the undisturbed state of the foundation soils and allow the placement of fill or backfill to the required density. The dewatering diversion system shall be installed and operated so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

- 3.05.** Open and cased sumps shall not be used as primary dewatering for excavation deeper than 3 feet below the static water table. Location of open or cased sumps shall be outside of trench excavation or limits of structural excavation.
- 3.06.** The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill, and prevent flotation or movement of structures, pipelines and sewers.
- 3.07.** Provision shall be made to take care of surplus water, mud, silt, slicking's or other runoff pumped from excavations and trenches or resulting from sluicing or other operations. Siltation of completed or partially completed structures and pipelines by surface water or by disposal of water from dewatering operations shall be cleaned up at the Contractor's expense.

PART 4 - PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 01563

SECTION 01660

EQUIPMENT TESTING AND PLANT STARTUP

PART 1 - GENERAL

Equipment testing and plant startup are required for satisfactory completion of the contract and shall be scheduled and completed within the contract time.

1.01 EQUIPMENT TESTING:

A. Contractor Furnished Equipment:

1. The Contractor shall provide the services of an experienced and authorized representative of the manufacturer of each item of equipment indicated in the equipment schedules who shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The Contractor shall have the manufacturer's representative revisit the Work site as often as necessary until any and all problems are corrected. The Contractor shall require that each manufacturer's representative furnish to the Engineer a written report addressed to the Owner certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts and has been operated satisfactorily under full-load conditions.
2. The Contractor shall be responsible for scheduling all operations testing. The Contractor shall furnish all personnel, power, water, chemicals, fuel, oil, grease and all other necessary equipment, facilities and services required for conducting the tests. The Contractor is advised that the Engineer and the Owner's operating personnel will witness operations testing and that the manufacturer's representative shall be required to instruct the Owner's operating personnel in correct operation and maintenance procedures. This instruction shall be scheduled with the Engineer and the Owner at least ten (10) working days in advance and shall be provided while the equipment is fully operational. The Contractor shall have previously furnished the technical manuals required under Section 01300 entitled, "Contractor Submittals".

1.02 PLANT STARTUP:

- A. The startup of the plant and equipment is a coordinating operation requiring the combined technical expertise of the Contractor, suppliers, Engineer and the Owner. The Contractor shall provide the effective coordination of all parties necessary for successful plant and booster pump facilities and equipment startup.
- B. The Contractor shall be required to startup and operate the various pieces of equipment for a continuous seven (7) day period under coordination direction of the Engineer and Owner. The startup shall not be commenced until all required leakage tests, disinfection and equipment tests have been completed to the satisfaction of the Engineer.
- C. All defects in materials or workmanship that appear during this test period shall be immediately corrected by the Contractor for the work performed by the Contractor. The Contractor shall provide the services of authorized representatives of the manufacturer, in addition to those services required under equipment testing, as may be necessary, to correct faulty equipment operation. Time lost for equipment repairs, wiring corrections, control point settings or other reasons which actually interrupt the startup may, at the discretion of the Engineer, be justifiable cause for extending the startup test duration.

END OF SECTION 01660

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 FINAL CLEANUP

- A. The Contractor shall promptly remove, from the vicinity of the completed work, all rubbish, unused materials, concrete forms, construction equipment and temporary structures and facilities used during construction. Final acceptance of the Work by the Owner will be withheld until the Contractor has satisfactorily complied with the requirements for final cleanup of the project site.

1.02 FINAL SUBMITTALS

- A. The Contractor, prior to requesting final payment shall obtain and submit the following items to the Engineer for transmittal to the Owner:
 - 1. Written guarantees, where required.
 - 2. Operating manuals, technical manuals and instructions per section 01730. The Contractor's attention is directed to the condition that one percent (1%) of the contract price will be deducted from any monies due the Contractor as progress payments if at the seventy-five percent (75%) construction completion point the approved technical manuals have not been submitted in accordance with Section 01300 entitled, "Contractor Submittals". The aforementioned amount will be retained by the Owner as the agreed estimated value of the approved technical manuals. Any such retention of money for failure to submit the approved technical manuals on or before the seventy-five percent (75%) construction completion point shall be in addition to the retention of any payments due to the Contractor as specified in Article 19 of the General Conditions.
 - 3. Manufacturers' representatives' installation, testing and startup reports
 - 4. Keying
 - 5. Maintenance stock items, spare parts and special tools
 - 6. Completed record drawings (As-Builts)
 - 7. Certificates of inspection and acceptance by local governing agencies having jurisdiction
 - 8. Releases from all parties who are entitled to claims against the subject project, property or improvement pursuant to the provisions of law
 - 9. Extension of Performance Bond in accordance with the Supplementary General Conditions

1.03 MAINTENANCE AND GUARANTEE

- A. The Contractor shall provide a bond to comply with the guarantee requirements contained in the General Conditions and the Supplementary General Conditions.
- B. The Contractor shall make all repairs and replacements promptly upon receipt of written order from the Owner. If the Contractor fails to make such repairs or replacements promptly the Owner reserves the right to do the Work and the Contractor and his surety shall be liable to the Owner for the cost thereof. Replacement of earth fill, backfill or resurfacing where it has settled below the required finish elevations shall be considered as part of such required repair work.

END OF SECTION 01700

SECTION 01730

OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this section.

1.02 SUMMARY

- A. Furnish six sets of bound operation and maintenance manuals and one electronic copy on compact disc or other approved form of media. Manuals shall contain descriptive drawings and data which identify equipment installed at the project and detail the procedures and parts required to maintain and repair the equipment. Copies of approved submittals shall be included for all equipment.

1.03 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS:

A. General

1. The "Operating and Maintenance Manual" is a bound compilation of drawings and data that the owner requires for each building or project. These manuals, complete with drawings and data, shall be furnished to the Owner.
2. The contractor has overall responsibility to obtain the necessary data from and compile the data as set forth in this specification, including items or equipment purchased by the Owner and delivered to the contractor for installation.
3. The number of binders (or "volumes") required for each individual building or project will depend on the amount of information to be catalogued.
4. All information included shall be legible and sufficiently marked to indicate the exact size, model, type, etc., of equipment furnished and installed.

- B. Purpose: The Operating and Maintenance Manual is prepared to provide a ready reference to all important pieces of mechanical and electrical equipment installed on the project. It is also to provide the necessary operating and maintenance data for use by service personnel. It is also to provide information required for checking equipment performance or for planning of plant expansion or redesign.

C. Quantity and Preparation (Submit through Engineer):

1. Six sets of the Operation and Maintenance Manuals shall be prepared for the project.
 - a. One set to the Engineer.
 - b. Five sets to Owner.
2. The quantities of drawings, manufacturer's literature, or other data required for these manuals are in addition to those otherwise required for normal distribution for approval during the construction period.

PART 2 - MATERIALS AND METHODS

2.01 PAGE SIZE

All pages shall be standard 8-1/2 x 11 inches size or approximate multiples (preferably 17 x 11 inches) folded to 8-1/2 x 11 inch manila pockets, which shall have standard three-ring side punching for insertion in the binders. The equipment name, drawing description and number shall be written on the face of each manila pocket.

2.02 DRAWINGS

All drawings larger than 8-1/2" x 11" shall be folded and inserted in individual 8-1/2" x 11" manila pockets, which shall have standard three-ring side punching for insertion in the binders. The equipment name, drawing description and number shall be written on the face of each manila pocket.

2.03 BINDERS

Binders shall be Buckram binders with block lettering for sheet size 8-1/2 x 11 inches with 2" to 3-1/2" expandable metal capacity as required for the project. The number of binders, however, shall be based on not filling them beyond 3 1/2".

2.04 THE FOLLOWING INFORMATION SHALL APPEAR ON THE FRONT COVER AND BACKBONE:

- A. "Operation and Maintenance Manual"
- B. Project Name (and volume number if more than one volume)
- C. "San Antonio Water Company"
- D. Engineer's name
- E. General Contractor's name (Item E need not be printed on the backbone.)

2.05 CONTENTS AND INDEXING

- A. Manuals shall contain descriptions of the building systems in sufficient detail to adequately indicate the type of systems installed and the basic details of their operation.
- B. All purchased equipment data shall be used to designate the sections. Within each section additional indexing of component parts may be required.
- C. Operation and Maintenance Manuals shall contain to the fullest extent all possible information pertinent to the equipment. The arrangement and type of information to be filed shall be as follows:
 - 1. Copy of purchase order change (if any).
 - 2. Outline drawings, special construction details, "as built" electrical wiring and control diagrams for all major and supplementary systems.
 - 3. Manufacturer's test or calculated performance data and certified test curves.
 - 4. Installation, operating, and maintenance instructions, including a complete parts list and sectional drawing with parts identification numbers. Mark with model, size and plan number.
 - 5. Manufacturer's brochure marked to indicate exact equipment purchased. Brochures on component parts supplied by a manufacturer with his equipment, but not manufactured directly by

him, shall also be included.

6. The serial numbers of each item of equipment installed are to be listed with the model numbers and plan symbols.
7. Written warranties.
8. Include a Table of Contents. The contents shall be divided with tabbed index dividers into the following suggested parts:
 - Part I Building and System Descriptions
 - Part II Pumps and Motors
 - Part III Mechanical and Electrical
 - Part IV Start-Up and Operation
 - Part V Preventative Maintenance Recommendations
9. A copy of the approved submittals for each piece of equipment
10. A copy of all testing, adjusting and balancing reports
11. Wiring diagrams marked with model and size and plan symbol
12. Operating and Maintenance Manuals data for Part I shall be obtained directly from the mechanical and electrical consultants. (Allow consultant preparation cost.)
13. The index shall contain the name and address of the manufacturer and, if different, where replacement and repair parts may be obtained

END OF SECTION 01730

SECTION 02050

EQUIPMENT, PIPING AND MATERIALS DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Requirements specified in the general conditions form a part of this section. Perform demolition, complete as indicated, specified and required. All work, during its progress, and upon completion, shall conform in every detail to the drawings and specifications. Should any detail or details be omitted from the drawings, then it shall be the responsibility of the contractor to furnish and execute such detail, so that on completion of the proposed construction and the site shall be acceptable, and fully operative as required.

1.02 WORK INCLUDED IN THIS SECTION. PRINCIPAL ITEMS ARE AS FOLLOWS:

- A. Removal from site and disposition in a legal manner of debris and all salvageable and demolished materials without on-site accumulation thereof.
- B. Obtain necessary permits, licenses and inspections as incidental to work of this Section.
- C. Protection of existing and new work from damage.
 - 1. Related Work Specified Elsewhere.
 - 2. Site preparation, earthwork, trenching and other work specified in pertinent Sections of the Specifications.

1.03 VERIFICATION OF CONDITIONS

- A. Prior to performance of demolition work, Contractor shall inspect the site, and perform the following:
 - 1. Thoroughly investigate on and off-site conditions as they affect work of this Section. Determine type of structures, improvements, new construction schedule and priorities and applicable requirements of governing authorities.
 - 2. Obtain and pay for all incidental licenses, permits, and inspections required by governing authorities.
 - 3. Perform work in a fully coordinated manner with Work of other Contractors and/or other trades to assure completion without interference or delay to progress of the Work.

1.04 REQUIREMENTS

- A. Work Sequence. Perform work in conformance with sequence requirements specified in pertinent sections of Specification Division 1.
- B. Methods and Timing. Prior to commencing any particular demolition work, Contractor shall submit in writing to the Owner a detailed proposal including time sequence and the methods which it proposes to use for the particular demolition operation. Delay demolition work in particular locations until the Owner has approved, in writing, the methods to be employed and has given notice to proceed. Approvals by the Owner of methods to be used in no way limits the responsibility of the Contractor under this Section.
- C. Facilities to Remain In Place. Precautions must be taken to insure that no damage is done to any facilities except those indicated for removal or relocation on the Drawings and Specifications.

Contractor will be held responsible for any costs whatsoever involved in any damage which he has caused to any work outside his Contract limits. The Contractor is warned that this clause will apply not only to existing facilities at the time of his bid, but also to any Work which has been constructed since his Bid or are being constructed at the time of this Contract. The Contractor is not only responsible for the costs of any repairs to any structures built or under construction, but also for any other costs which are attributable to his actions.

1.05 PIPES, UTILITIES AND CONDUITS

- A. The locations where pipes and conduits are to be encountered are generally shown on the Drawings. Where the location for cutting is not shown, the pipe or conduit shall be cut at the limit of demolition or at some other location approved in advance by the Owner.
- B. Contractor shall inform the Owner 72 hours prior to the cutting of any pipes or conduits. All pipes or conduits which he locates and which are not shown on the Drawings shall be brought to the attention of the Owner.
- C. Pipes, conduits, utilities, etc., which are required to be cut shall be either temporarily or permanently capped as specified by the Contract Documents or rerouted as indicated on the Drawings. Utility lines not specifically noted for disposition, but which are encountered in the Work shall be capped, extended, protected, or reworked as necessary for completion of the work as directed by the Owner.
- D. Debris Removal. All rubble, debris, and waste materials generated during the demolition procedures shall be removed by the Contractor from the site as it accumulates. The whole of the site occupied by the Contractor shall be kept in a clean and orderly state. The Contractor, at his own expense, shall find suitable dumping grounds for the waste materials and it shall be his responsibility to pay any costs whatsoever involved in securing the dumping grounds. The dumping ground site shall be approved by all relevant authorities. It is the Contractor's responsibility to seek and obtain such approval and to file with the Owner copies of all approvals or agreements so obtained.

1.06 PROTECTION

- A. Take care to prevent spread of dust and flying particles. Sprinkle rubbish and debris with water to keep dust to a minimum.
- B. Maintain adequate fire protection, including extinguishers and operative water-hose lines during demolition at locations where occurrence of fire is possible.
- C. Provide temporary barricades, fences and safeguards to eliminate hazards to persons and property without interference to use of adjacent property, public rights-of-way, utilities and structures.

1.07 SAFETY RULES AND REGULATIONS

- A. Perform demolition in conformance with applicable requirements of Article 31, Demolition, of Construction Safety Orders of the California Division of Occupational Health and Safety
- B. Piping with lead based paint shall be removed in conformance with applicable OSHA requirements

PART 2 - EXECUTION

3.01 PERFORMANCE, GENERAL

- A. Perform Work by employing personnel experienced in this type of work and in such manner as to eliminate hazards to persons and property without interference with new work and with use of adjacent areas, public rights-of-way, utilities and structures.
- B. Except as otherwise indicated or directed, salvageable items, rubbish and debris resulting from demolition shall become property of Contractor, be disposed of off-site, and not be allowed to accumulate or be buried in fills.
- C. Perform all work in conformance with applicable requirements of Safety Orders hereinbefore specified in Article 1.05, Safety Rules and Regulations.
- D. Utilities.
 - 1. Notify utility firms having Owner-owned equipment on site. Assure of its disconnection and removal before commencing demolition.
 - 2. Seal in an approved manner all utility services encountered during work of this Section.
 - 3. Remove and dispose off-site all abandoned piping, conduits and other utilities inside area of new construction.

3.02 EXISTING PAVEMENT

- A. Neatly cut existing pavement along straight lines to such dimension as necessary to perform new work. Prior to resurfacing, pavement edges adjacent to excavations shall be trimmed to neat straight lines to assure that all areas to be resurfaced are accessible to the rollers or equipment to be used to compact the subgrade, base course and paving materials.

3.03 EXISTING IN-USE PIPING

- A. When cutting into existing in-use piping special care shall be taken to prevent disturbance of the existing pipe bedding and jointing. Carefully drill and/or saw-cut openings without the use of impact tools. Method shall result in the elimination of debris spillage into existing pipeline. Exercise care in the removal of cut out sections to avoid spillage into existing piping.

3.04 DISPOSAL OF ABANDONED PIPING AND CONCRETE STRUCTURES

- A. Existing abandoned piping shall be cut out and removed to facilitate installation of new work. Existing concrete paving shall be removed to limits necessary for construction of new work. Existing abandoned pipes which are allowed to remain in place and which have been cut into shall have openings suitably plugged with nonshrink grout or mortared in place masonry plugs. Concrete reservoir, roofing and appurtenances shall be removed from site and disposed of in a legal manner without on-site accumulation thereof by the Contractor.

3.05 CLEANING

- B. Contractor shall keep his work and the adjacent areas affected, free and clear from all debris caused by the work of this Section. During and upon completion of work herein specified, remove from building and site all debris, unused materials and equipment caused by work of this Section, and leave Work in a clean, acceptable condition.

END OF SECTION 02050

SECTION 02100 - CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 Description

- A. Clear and grub the site as shown on the Drawings and specified in this Section.

1.02 Quality Assurance

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 - MATERIALS

Provide materials, not specifically described but required for proper completion of the work of this Section, as selected by the Contractor subject to the approval of the Owner.

PART 3 - EXECUTION

3.01. Surface Conditions

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.02. Protection

- A. Protect existing utilities indicated or made known.
- B. Tree Root Protection Policy – At no time shall any materials, supplies or fill be stored and/or equipment be parked or driven within the prescribed root protection zone unless otherwise directed by the Engineer. The root protection zone is defined as the larger of the drip line of the tree or the distance from the trunk equal to six (6) inches for each inch of trunk diameter measured at 4.5 feet above existing grade.

It is recognized that failure to abide by these provisions will result in substantial root damage to trees that may not be immediately apparent. The City will therefore assess damages according to the International Society of Arboriculture standards and a deduction will be made from the Contractor's payment.

Tree Removal– Tree removal shall be performed as shown on the plans.

- C. Protection of persons and property:
 - 1. Barricade open excavations and holes occurring as part of this work, and post warning lights on property adjacent to or within public access.
 - 2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 - 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this section.
- D. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to

other work being performed on or near the site.

- E. Maintain access to the site at all times.
- F. Any damage due to the negligence of the Contractor shall be repaired, to the City's satisfaction, or the item replaced as directed by the engineer, at the expense of the contractor.

3.03. Clearing

- A. Clean out roots 1/2-inch in diameter and larger to a depth of at least 12-inches below the existing ground surface or subgrade of new graded surface, whichever is lower. Treat roots remaining in the soil with a weed killer approved by the Owner.

3.04. Conservation of Topsoil and Existing Landscaping/Groundcover

- A. After the area has been cleared of vegetation, strip the existing topsoil to the depth necessary to provide at least 6-inch depth of topsoil in areas shown on the Drawings to be turfed or planted, without contamination with subsoils.
- B. Stockpile in an area clear of new construction.
- C. Maintain the stockpile in a manner which will not obstruct the natural flow of drainage.
 - 1. Maintain stockpile free from debris and trash.
 - 2. Keep the topsoil damp to prevent dust and drying out.
- D. Disturbed vegetation shall be replaced in kind approved by the Owner.

3.05. Disposal

- A. General:
 - 1. Remove brush, grass roots, trash, and other material from clearing operations.
 - 2. Dispose of away from the site in a legal manner.
 - 3. Do not store or permit debris to accumulate on the job site.
- B. Do not burn debris at the site!

3.06. Utilities

- A. Coordinate with utility companies and agencies as required.
- B. Where utility cutting, capping, or plugging is required, perform such work in accordance with requirements of the utility company or governmental agency having jurisdiction.

PART 4 - PAYMENT

Payment of the work in this section will be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 02100

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of earthwork for excavations and fills. See Section 02223 for pipeline trenching, backfilling and compaction requirements.

1.02 SUBMITTALS

- A. Submit excavation and shoring drawings for worker protection in accordance with Section 01300.
- B. Submit six (6) copies of a report from a testing laboratory verifying that imported material conforms to the specifications for subgrade, structural fill and pipe bedding.

1.03 TESTING FOR COMPACTION

- A. The Contractor shall be responsible for all moisture control of soils required for fill or foundations.
- B. Tests specified below will be performed by the Owner's Representative during the progress of the work to determine compliance with the compaction requirements specified herein, and the Contractor shall cooperate on the making of such tests by providing the labor and equipment necessary to obtain said tests at the required depth and allowing a reasonable time therefore.
- C. Testing by the Owner is for verification that contract requirements are met and is not for Contractor's quality control. Contractor is responsible for adequacy of all backfill materials meeting contract requirements.
- D. Determine the density of soil in place by the sand cone method, ASTM D 1556 or by nuclear methods, ASTM D 2922 and D 3017.
- E. Determine laboratory moisture-density relations of soils by ASTM D 1557.
- F. Determine the relative density of cohesionless soils by ASTM D 4253 AND D 4254.
- G. Sample backfill materials by ASTM D 75.
- H. "Relative compaction" is the ratio, expressed as a percentage, of the in-place dry density to the laboratory maximum dry density.
- I. Any test showing compaction less than the specified relative compaction shall be deemed not to comply with the specifications. The area shall be reworked and/or rerolled until all tests in the area meet the specified relative compaction. The Contractor shall be responsible for the costs of all failing tests.

1.04 DISPOSAL OF EXCESS MATERIALS

Excess site excavated or wasted material shall be disposed of offsite in a timely basis by the Contractor, at his expense.

PART 2 - MATERIALS

2.01 FILL MATERIAL

- A. Material to be placed as fill shall be free of organic matter and other deleterious substances, and shall be approved by the Owner.
- B. Material to be placed as fill shall be non-corrosive and non-expansive.
- C. Oversize material defined as rock or other irreducible material with a maximum dimension greater than 3 inches, shall not be buried or placed in fills.
- D. If importing of fill material is required for grading, the import material shall meet the requirements above. The Contractor shall provide laboratory test results and/or certification demonstrating that fill materials meet the requirements of the Contract Documents.

2.02 STRUCTURAL BACKFILL

- A. Material for structural backfill shall be free from clay balls and organic, corrosive or otherwise deleterious material, and shall have a sand equivalent greater than 30 per ASTM D 2419 and shall have the following gradation:

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
3 inch	100
1/2 inch	90 - 100
3/8 inch	50 - 100
No. 8	5 - 50
No. 200	0 - 10

- B. Excavated material may be used for structural backfill provided it conforms to the above specifications for structural backfill material.

2.03 SAND

Granular material free from clay balls, organic matter, and other deleterious substances and conforming to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
1/2 inch	100
No. 4	70 - 100
No. 16	35 - 75
No. 50	10 - 40
No. 200	0 - 10

Sand shall have a minimum sand equivalent of 30 per ASTM D 2419.

2.04 CRUSHED AGGREGATE BASE

- A. General
 - 1. Crushed aggregate base (CAB) shall consist entirely of crushed rock and rock dust conforming to the requirements of Section 400-2, Standard Specifications for Public Works

Construction (Greenbook, latest edition).

B. Grading

The aggregate shall be uniformly graded and shall conform to the following:

CRUSHED AGGREGATE BASE	
Sieve Size	Percentage Passing Sieve
1 1/2 "	100
3/4"	90 - 100
3/8"	50 - 80
No. 4	35 - 55
No. 30	10 - 30
No. 200	2 - 9
ASTM C 131 Test Grading	B

C. Quality Requirements

The material shall conform to the following:

QUALITY REQUIREMENTS			
Tests	Test Method No.		Requirements
R-Value ¹	Calif.	301	80 Min.
Sand Equivalent	Calif.	217	50 Min.
Percentage Wear	ASTM C 131		
100 revolutions			15 Max.
500 revolutions			52 Max.
Specific Gravity (Bulk saturated surface dry)	ASTM C 127		2.58 Min. ²

D. The R-Value requirement will be waived, provided the material has an SE of 55 or more.

E. Not more than 15 percent by weight shall be particles with a bulk specific gravity below 2.50.

The Engineer may waive percentage wear and specific gravity requirements, provided that the material has a minimum durability of 40 in accordance with Calif. Test 229.

2.05 WATER FOR COMPACTION

Water shall be free of organic materials and shall have a pH of 7.0 to 9.0, a maximum chloride concentration of 500 mg/l, and a maximum sulfate concentration of 500 mg/l. Provide all water needed for earthwork. Provide temporary piping, valves, meters and backflow devices, as required, to convey water from the source

to the point of use.

PART 3 - EXECUTION

3.01 DEWATERING

Contractor shall provide and operate equipment adequate to keep excavations and trenches free of water. Remove water during period when concrete is being deposited, when pipe is being laid, and during the placing of backfill. Avoid settlement or damage to adjacent property. Dispose of water in a manner that will not damage adjacent property. When dewatering open excavations, dewater from outside the structural limits and from a point below the bottom of the excavation. Comply with all discharge rules and regulations.

3.02 EXCAVATION

- A. Perform all excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Do not operate excavation equipment within 5 feet of existing structures or near newly completed construction. Excavate with hand tools in these areas.
- B. After the required excavation has been completed, the Owner will observe the exposed subgrade to determine the need for any additional excavation. It is the intent that additional excavation be conducted in all areas within the influence of the structure where unacceptable subgrade material exists at the exposed subgrade. Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the structure or within a zone outside and below the structure defined by a line sloping at 1 horizontal to 1 vertical from 1 foot outside the edge of the footing. Refill the overexcavated areas with structural backfill material.

3.03 LIMITS OF FOUNDATION EXCAVATION

Excavate to the depths and widths shown on drawings. Allow for forms, working space, structural backfill, and site grading. Do not carry excavation for footings, slabs, or conduits below elevations indicated. Stockpile all excavated materials beyond a 1:1 plane drawn upward from the lower of the base of shoring or excavation. Unless unacceptable material is encountered and overexcavation is authorized by the Owner, backfill over excavations with compacted structural backfill material. Correct cuts below grade by benching adjoining areas and creating a smooth transition. The Contractor shall bear all costs for correcting unauthorized overexcavated areas.

3.04 PREPARATION FOR PLACING FILL

- A. All brush, vegetation and debris shall be removed, piled and/or otherwise disposed of per Section 02100.
- B. The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of 12 inches. Existing ground which is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until the soils are broken down and free of large clay lumps or clods and until the working surface is reasonably uniform and free of uneven features which would inhibit uniform compaction.
- C. Soft, dry, spongy, highly fractured or otherwise unsuitable ground, extending to such a depth that surface processing cannot adequately improve the condition, shall be overexcavated down to firm ground, approved by the Owner.
- D. Over excavated and processed soils shall be watered, dried-back, blended, and/or mixed, as required to attain a uniform moisture content near optimum.
- E. Over excavated and processed soils which have been properly mixed and moisture-conditioned shall be recompacted to a minimum relative compaction of 90 percent.

- F. All areas to receive fill, including processed areas, shall be approved by the Owner prior to fill placement.
- G. Remove form materials and trash from the excavation before placing any fill material. Obtain the specified compressive strength and finish of concrete work per Sections 03000 before backfilling.
- H. Do not operate earthmoving equipment within 5 feet of walls or concrete structures. Place and compact fill or backfill adjacent to concrete walls with hand-operated tampers or other equipment that will not damage the structure.

3.05 PLACING AND COMPACTING FILL

- A. Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 6 inches in compacted thickness. The Owner may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.
- B. Fill layers at a moisture content less than optimum shall be watered and mixed, and wet fill layers shall be aerated by scarification or shall be blended with drier material. Moisture-conditioning and mixing of fill layers shall continue until the fill material is at a uniform moisture content at or near optimum.
- C. After each layer has been evenly spread, moisture-conditioned, and mixed it shall be uniformly compacted to not less than 90 percent of maximum dry density. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.
- D. Field tests to check the fill moisture and degree of compaction will be performed by the Owner. The location and frequency of tests shall be at the discretion of the Owner. In general, the tests will be taken at an interval not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of embankment.

3.06 MOISTURE CONTROL OF BACKFILLS

During the compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of the backfill material. Maintain moisture content uniform throughout the lift. Insofar as practical, add water to the material at the site of excavation. Supplement by sprinkling the backfill material. At the time of compaction, the water content shall be within % of the optimum moisture content. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

3.07 SITE GRADING

- A. Perform earthwork to the lines and grades shown on the drawings. Carefully remove exposed roots and loose rocks as may be necessary to perform excavations.

PART 4 - PAYMENT

Payment of the work in this section will be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 02200

SECTION 02222

PROTECTING EXISTING UNDERGROUND UTILITIES

PART 1 - GENERAL

1.01 GENERAL

This section describes materials and procedures for protecting existing underground utilities.

PART 2 - MATERIALS

2.01 REPLACEMENT IN KIND

Except as indicated on the drawings or as specifically authorized by the Owner, reconstruct utilities with new material of the same size, type, and original quality as that removed.

PART 3 - EXECUTION

3.01 GENERAL

- A. Replace in kind improvements that are cut, removed, damaged, or otherwise disturbed by the construction.
- B. Where utilities are parallel to or cross the pipeline trench but do not conflict with the permanent work to be constructed, follow the procedures given below and as indicated on the Drawings. Notify the utility district 48 hours in advance of the crossing construction and coordinate the construction schedule with the utility district's requirements.
- C. Determine the true location and depth of utilities and service connections which may be affected by or affect the work. Determine the type, material, and condition of these utilities. The Contractor shall pothole all utilities, except those listed in the contract documents as already being potholed, prior to submitting pipe laying drawings. The Contractor shall submit a set of potholing plans to the Owner prior to submitting laying diagrams. In addition, the Contractor shall expose all utilities at least 500 lineal feet in advance of the start of pipeline excavation.

3.02 PROCEDURES

- A. Protect in Place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise specified on the Drawings or in the Specifications.
- B. Cut and Plug Ends: Cut abandoned utility lines (conduits) and plug the ends with brick and mortar or concrete plug. Plug utility lines with an 8-inch wall of brick and mortar or 8 inch concrete plug from the cut end of the pipe. Dispose of the cut pipe as unsuitable material.
- C. Contractor shall provide temporary support for all pipelines crossing the proposed trench. All pipelines 18 inches in diameter or larger crossing over the proposed water main with less than 4 feet of clearance shall have a temporary support. Contractor shall submit drawings of his method of temporary support to the Engineer for review. All pipelines less than 18 inches in diameter and crossing over the proposed water main with less than 2 feet of clearance shall be protected by pouring a one (1) sack sand/cement slurry from the top of the water main to the bottom of the crossing pipeline.

3.03 ABANDONED UTILITIES

Remove and dispose of abandoned utilities within the trench excavation.

PART 4 - PAYMENT

Payment of the work in this section will be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 0222

SECTION 02223

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01. Description – This section describes materials, testing, and performance of trench excavation, backfilling, and compacting.

1.02. Related Work Specified Elsewhere

- A. Concrete: 03300.
- B. Hydrostatic Testing of Pressure Pipelines: 15042.

1.03. Submittals

- A. Submit shop drawing in accordance with Section 01300.
- B. Shop drawings shall be submitted showing excavation and shoring, bracing, or sloping for worker protection.
- C. Six copies of a report from a testing laboratory shall be submitted verifying that backfill material conforms to the specified gradations or characteristics for pea gravel, granular material, imported sand, rock refill for foundation stabilization, and water.

1.04. Measurement and Payment Not used

1.05. Protection of Existing Utilities and Facilities

- A. General: The Contractor shall be responsible for the care and protection of all existing sewer pipelines, water pipelines, gas mains, storm drains, culverts, or other facilities and structures that may be encountered in or near the area of work.
- B. Notification: It shall be the duty of the Contractor to notify each agency of jurisdiction and make arrangements for locating each agency's facilities prior to beginning construction. The Contractor shall notify Underground Services Alert (Dig Alert) at least two working days prior to construction at 811.
- C. Damage: In the event of damage to any existing facilities during the progress of the work due to the failure of the Contractor to exercise the proper precautions, the Contractor shall be responsible for the cost of all repairs and protection to said facilities. The Contractor's work may be stopped until repair operations are complete.

In the event that the Contractor hits and damages an unmarked facility, resulting in a change order, the Contractor shall be responsible for collecting reimbursement from the agency that failed to properly mark their facility. The Owner shall not be responsible or assist in the reimbursement process.

1.06. Protection of Landscaping

- A. General: The Contractor shall be responsible for the protection of all the trees, shrubs, fences, and other landscape items adjacent to or within the work area, unless directed otherwise on the plans. In the event of damage to landscape items, the Contractor shall replace the damaged items in a manner satisfactory to the Owner Representative.

- B. Restoration: After the completion of work in planted or improved areas within public or private easements, the Contractor shall restore such areas to original condition. Restoration shall include regrading, placement of 5-inches of topsoil, reseeding, and replacement of landscaping.

PART 2 - MATERIALS

2.01. Definition of Zones

- A. Pavement Zone: The pavement zone shall include the asphaltic concrete and aggregate base pavement section placed over the street zone. This zone is often referred to as the “structural section” of the street or highway.
- B. Trench Zone: The trench zone shall include the portion of the trench from the top of the pipe zone to the bottom of the pavement zone in paved areas or to the existing surface in unpaved areas.
- C. Street Zone: The street zone is a portion of the trench zone to be defined by the jurisdictional agency, and is immediately below the pavement zone in paved areas or areas to be paved.
- D. Pipe Zone: The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level 12-inches above the top of the pipe. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipes to a horizontal level above the top of the highest or topmost pipe.
- E. Pipe Base: The pipe base shall be defined as a 6-inch layer of material immediately below the pipe zone and extending over the full trench width.

2.02. Trench Zone

- A. Native earth backfill shall be excavated, fine-grained non-organic materials free from peat, roots, debris, and rocks larger than 3-inches, and which can be compacted to the specified ~~relative~~ compaction, unless otherwise directed by the jurisdictional agency.
- B. Trench zone backfill for all public streets within the Owner shall be per the Owner standard, as directed by the Owner Representative. Refer to ~~the~~ Owner for specifications.

2.03. Backfill--Pipe Zone and Pipe Base

- A. Ductile iron pipe, welded steel pipe (CML&C), PVC pressure pipe, pretensioned concrete cylinder pipe, pre-stressed concrete cylinder pipe, PVC-lined reinforced concrete pipe, and copper pipe: Unless otherwise specified or shown on the plans, the pipe base and pipe zone backfill material shall be imported sand as specified herein.
- B. Sewer vitrified clay pipe: Unless otherwise specified or shown on the plans, pipe base and pipe zone backfill material shall be ¾-inch crushed rock as specified herein.

1. Imported Sand--Pipe Zone and Pipe Base

Imported sand used in the pipe zone or for the pipe base shall have the following gradation:

Sieve Size	Percent Passing by Weight
3/8"	100
No. 4	75-100
No. 30	12-50
No. 100	5-20
No. 200	0-15

Minimum sand equivalent shall be 30 per ASTM D 2419.

2. Gravel and Crushed Rock--Pipe Zone and Pipe Base

Gravel or crushed rock material shall conform to the California Standard Specifications for Public Works Construction, Section 200-1.2 and shall meet the following gradation:

Sieve Size	Designated Material Size			
	1-1/2-inch	1-Inch	3/4-Inch	3/8-Inch
	Percent Passing	Percent Passing	Percent Passing	Percent Passing
2-inches	100	--	--	--
1-1/2-inches	90-100	100	--	--
1-inch	20-55	90-100	100	--
3/4-inch	0-15	30-60	90-100	--
1/2-inch	--	0-20	30-60	100
3/8-inch	0-5	--	0-20	90-100
No. 4	--	0-5	0-5	30-60
No. 8	--	--	--	0-10

3. Refill Material for Foundation Stabilization

Refill material below the pipe shall be either material conforming to the 1½-inch size requirement for gravel or crushed rock, or naturally occurring rock having the following gradation:

Sieve Size	Percent Passing by Weight
3"	100
1-1/2"	70-100
3/4"	60-100
No. 4	5-55
No. 30	0-30
No. 200	0-10

2.04. Sand-Cement Slurry Refill Material for Foundation Stabilization in Pipe Base and Pipe Zone or Backfill for Street Zone and Trench Zone.

Sand-Cement slurry shall consist of 1½ sacks of Portland cement per cubic yard of sand and sufficient moisture for workability.

2.05. Pea Gravel

Pea gravel shall be defined as gravel, uniformly graded from coarse to fine with less than 10% passing a No. 200 sieve, less than 50% passing a No. 4 sieve, and having a maximum particle size of ¾-inch.

2.06. Water for Compaction

Water used in compaction shall have a maximum chloride concentration of 500 mg/l, a maximum sulfate concentration of 500 mg/l, and shall have a pH of 7.0 to 9.0. Water shall be free of acid, alkali, or organic materials injurious to the pipe coatings.

2.07. Pavement Zone Materials

Pavement zone materials shall be as specified in Section 02578, Pavement Removal and Replacement unless otherwise specified by a jurisdictional agency permit.

PART 3 - EXECUTION

3.01. Testing for Compaction

- A. Methods: The density of soil shall be determined in place by the sand cone method, ASTM D 1556, or by the nuclear method, ASTM D 2922 or D 3017.
- B. Soil Moisture-Density Relationship: The laboratory moisture-density relations of soils shall be determined per ASTM D 1557.
- C. Cohesionless Materials: The relative density of cohesionless materials shall be determined by ASTM D 4253 and D 4254.
- D. Sampling: Backfill materials shall be sampled per ASTM D 75.
- E. Relative Compaction: "Relative compaction" shall be expressed as the ratio, expressed as a percentage, of the in place dry density to the laboratory maximum dry density.

- F. Compaction Compliance: Compaction shall be deemed to comply with the specifications when none of the tests falls below the specified relative compaction. When tests are conducted by the Owner, the Contractor shall notify the Owner 24-hours in advance of when backfill lifts are ready for testing, and shall pay the costs of any retesting of work not conforming to the specifications.

3.02. Compaction Requirements

- A. Unless otherwise shown on the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:
1. Pipe Base and Pipe Zone: Pipe base and pipe zone--90% relative compaction. Note 95% relative compaction requirement in specific areas shown on the plan and profile drawings.
 2. Trench Zone - Not Beneath Paving: Backfill in trench zone not beneath paving: 90% relative compaction.
 3. Trench Zone - Paved Areas: Backfill in trench zone in paved areas: 90% relative compaction.
 4. Street Zone: Backfill in street zone in paved areas: 95% relative compaction, or as required by the jurisdictional agency.
 5. Foundation Stabilization: Rock refill material for foundation stabilization: 90% relative density.
 6. Overexcavation: Rock refill for overexcavation: 90% relative density.
 7. Material Testing: All imported or native materials shall be tested before the start of compaction on operations to determine the moisture density relationship for materials with cohesive components, and the maximum density for cohesionless materials. Variations in imported or native earth materials may require a number of base curves of the moisture-density relationship.
 8. Testing Intervals: Unless noted otherwise, compaction tests shall be performed at random depths and at 200-foot intervals, and as directed by the Owner's Representative.

3.03. Material Replacement

- A. Trenching and backfilling material which does not meet the specifications shall be removed and replaced at no additional expense to the Owner.

3.04. Sheet piling, Shoring, and Bracing of Trenches

- A. Trenches shall have sheet piling, shoring, and bracing conforming to CAL/OSHA requirements and General Provisions. Lateral pressures for design of trench sheet piling, shoring, and bracing shall be based on type of soil exposed in the trench, groundwater conditions, surcharge loads adjacent to the trench, and type of shoring that will be used in the trench.

3.05. Sidewalk, Pavement, and Curb Removal

- A. Bituminous and concrete pavements regardless of the thickness and curbs and sidewalks shall be cut prior to excavation of the trenches in accordance with Section

02578, Pavement Removal and Replacement. Pavement and concrete materials shall be removed from the site and shall not be used for trench backfill.

3.06. Trench Width

- A. Pipe Diameter 12-inches and Greater: Unless shown otherwise on the drawings, trench widths in the pipe zone shall be equal to the pipe outside diameter plus 12- inches minimum and 16 inches maximum. Trench width shall be the same from trench bottom to top.

3.07. Grade

- A. Trenches shall be excavated to the lines and grades shown on the drawings with allowance for pipe thickness and for pipe base. If the trench is excavated below the required grade, the portion of the trench excavated below the grade shall be refilled with refill material at no additional cost to the Owner. The refill material shall be placed over the full width of trench in compacted layers not exceeding 6-inches deep to the required grade with allowance for the pipe base. Hard spots that would prevent a uniform thickness of pipe base shall be removed. Before laying pipe sections, the grade shall be checked with a straightedge and any irregularities corrected. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point.

3.08. Pipe Base Thickness

- A. Thickness of the pipe base shall be as shown on the drawings or as otherwise described in the specifications for the particular type of pipe installed, but in no cases shall the thickness be less than 6-inches.

3.09. Dewatering

- A. Means and Devices: Suitable means and devices shall be provided and maintained to continuously remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until the backfill at the pipe zone has been completed. These provisions shall apply during the noon hour as well as overnight. Water shall be disposed of in a manner to prevent damage to adjacent property. Trench water shall not be drained through the pipeline under construction. Groundwater shall not be allowed to rise around the pipe until jointing compound has firmly set.
- B. Notification: The Owner shall be notified 48 hours prior to commencement of dewatering. Methods employed shall be in conformance with NPDES permit procured by the contractor.

3.010. Storage of Excavated Material

- A. During trench excavation, excavated material shall be stored only within the working area. Roadways or streets shall not be obstructed. The safe loading of trenches with excavated material shall conform to federal, state, and local codes.

3.011. Length of Open Trench

- A. The length of open trench shall be limited to 600 feet in advance of pipe laying or amount of pipe installed in one working day. Backfilling and temporary or first layer paving shall be completed so that not more than 500 feet of trench is open in the rear of pipe laying. Sidewalks, driveways and other traveled ways shall be backfilled or adequately bridged to provide safe access and egress at the completion of each day's work.

3.012. Foundation Stabilization

- A. After the required excavation has been completed, the Owner Representative shall inspect the exposed trench subgrade to determine the need for any additional excavation. It is the intent that additional excavation shall be conducted in all areas within the influence of the pipeline where unacceptable materials exist at the exposed subgrade. Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the pipe base and to the depth required. The presence of unacceptable material may require excavating a wider trench. The width and depth of known areas to be overexcavated shall be shown on the drawings. The overexcavated portion of the trench shall be backfilled to the subgrade of the pipe base with refill material for foundation stabilization. Foundation stabilization material shall be placed over the full width of the excavation and compacted in layers not exceeding 6-inches in depth, to the required grade.

3.013. Trench Backfilling and Compaction

- A. General: Trench backfill shall conform to requirements of the detailed piping specification for the particular type of pipe and following.
- B. Pipe Base: The specified thickness of pipe base material shall be placed over the full width of trench. The top of the pipe base shall be graded ahead of the pipe laying to provide firm, uniform support along the full length of pipe.
- C. Bell Holes: Bell holes shall be excavated at each joint to permit proper assembly and inspection of the entire joint.
- D. Pipe Zone: After the pipe has been bedded, pipe zone material shall be placed simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. Material shall be carefully placed around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Particular care shall be taken in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling. Material placed within the pipe zone shall be compacted by hand tamping only, unless otherwise specified. Compaction by jetting shall be permitted only where required by the jurisdictional agency.
- E. Trench Zone: Backfill material shall be carefully deposited onto the backfill previously placed in the pipe zone. Free fall of the material shall not be permitted until at least 2 feet of cover is provided over the top of the pipe. Sharp, heavy pieces of material shall not be dropped directly onto the pipe or the tamped material around the pipe.
- F. Trench Backfill: Trench backfill shall be compacted to the specified relative compaction. Compaction shall be performed by using mechanical compaction or hand tamping equipment. Consolidation by jetting or flooding shall be permitted only where required by the jurisdictional agency. High impact hammer-type equipment shall not be used except where the pipe manufacturer warrants in writing that such use will not damage the pipe.
- G. Equipment: Axle-driven or tractor-drawn compaction equipment shall not be used within 5 feet of walls and structures.
- H. Street Zone Backfill: Street zone backfill shall be done in accordance with the requirements and to the satisfaction of the County or Owner agency having jurisdiction. Street zone backfill can be placed with mechanical compaction.

3.014. Compacted Embankment

- A. Earthwork for construction of compacted embankment shall be as specified in Section

02200, Earthwork and Grading.

3.015. Import or Export of Backfill Material

- A. Excess Material: Excess excavated soil material shall be removed and disposed of off the project site at no additional expense to the Owner. Excess soil material shall be disposed of in accordance with local regulations.
- B. Imported Material: Any additional backfill material necessary to return all grades to plus or minus 0.2 feet from the grade encountered at the beginning of construction or as shown on the contract drawings shall be imported, placed, and compacted at no additional cost to the Owner. Only approved imported material is allowed.

3.016. Moisture Content of Backfill Material

- A. During the compacting operations, optimum practicable moisture content required for compaction purposes shall be maintained in each lift of the backfill material. Moisture content throughout the lift shall be maintained at a uniform level. If placement is discontinued and proper moisture content not maintained, the upper layer shall be brought back to proper moisture content by sprinkling, cultivating and rolling the backfill material before placing new material. At the time of compaction, the water content of the material shall be at optimum water content plus or minus two percentage points. Material which contains excessive moisture shall not be worked to obtain the required compaction. Material having excessive moisture content may be dried by blading, discing, or harrowing to hasten the drying process.

END OF SECTION 02223

SECTION 02513 - ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

Provide asphaltic concrete paving where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

- A. Submit in accordance with Section 01300.
- B. Materials list of items proposed to be provided under this Section;
- C. Certificates, signed by the materials producer and the asphalt paving subcontractor, stating that materials meet or exceed the specified requirements.

1.03 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 - MATERIALS

2.01 AGGREGATES

- A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable, mineral materials processed and blended, and naturally combined.
- B. Aggregate base material shall be crushed aggregate base (C.A.B.) per Section 400-2 of the SSPWC.
- C. Base course aggregate maximum size:
 - 1. Base courses over 6 inches thick: 1 1/2-inches;
 - 2. Other base courses: 3/4 inch
- D. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions consistent with Column C2 of table 203-6.4.36 (A) of the SSPWC.

Plus 50/60 penetration liquid asphalt at 5 percent to 6.5 percent of the combined dry aggregates.

2.02 WEED KILLER

- A. Provide a dry, free-flowing, dust-free chemical compound containing not less than 30 percent sodium chlorate or a chlorateborate compound, non-flammable, not creating a fire

hazard when applied in accordance with the manufacturer's recommendations, soluble in water, and capable of being spread dry or in solution.

B. Acceptable products:

1. "Chlorax 40": Chipman Chemical Company, Inc., Palo Alto, California
2. "Monobar-Chlorate": U.S. Borax and Chemical Corp., Los Angeles, California.

2.03 ASPHALTS

A. The asphaltic concrete for this project shall be grade AR4000. Comply with provisions of Asphalt Institute Specification SS-2:

1. Asphalt cement: Penetration grade 50/60.
2. Prime coat: Cut-back type, grade MC-250.
3. Tack coat: Uniformly emulsified, grade SS-1H.

2.04 SEALER

1. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.
2. Apply sealer 30 days after placing and compacting AC pavement to allow volatiles to escape from the Pavement
3. Acceptable products:
 - a. "Laycold Walk Top": Chevron Asphalt Company, San Pedro, California.

2.05 MIXING ASPHALTIC CONCRETE MATERIALS

1. Provide hot plant mixed asphaltic concrete paving materials.
 - a. Temperature leaving the plant: 290 degrees F minimum, 320 degrees F maximum.
 - b. Temperature at time of placing: 280 degrees F minimum.

2.06 HEADERS AND STAKES

Provide redwood, construction grade, in dimensions shown on the Drawings or as required for the particular use where dimensions are not shown on the Drawings.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 FINAL PREPARATION OF SUBGRADES

- A. After preparation of subgrade as specified in another Section of these Specifications, thoroughly scarify and sprinkle the entire area to be paved, and then compact to a smooth, hard, and even surface of 95 percent compaction to receive the aggregates.
- B. Apply weed killer to the entire area to be paved. Adhere to the manufacturer's application recommendations.

3.03 PLACEMENT OF BASE COURSES

- A. Subbase (when required):
 - 1. Spread the specified subbase material to a thickness providing the compacted thickness shown on the Drawings.
 - 2. Compact to 95 percent.
- B. Base:
 - 1. Spread the specified base material to a thickness providing the compacted thickness shown on the Drawings.
 - 2. Compact to 95 percent.
 - 3. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0 inches to plus 0.5 inches.
 - 4. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 3/8-inch in ten feet.
 - a. Deviations: Correct by removing materials, replacing with new materials, and reworking or recompacting as required.
 - 5. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.04 PLACEMENT OF ASPHALTIC CONCRETE PAVING

- A. Install the specified headers and stakes to achieve the arrangement of paving shown on the Drawings.

- B. Remove all loose materials from the compacted base.
- C. Apply the specified prime coat, and tack coat where required, and allow to dry, in accordance with the manufacturer's recommendations. Tack coat shall be applied per Section 302-5.4 of the SSPWC, latest edition.

Prime coat may be omitted if all of the following conditions are met:

1. Asphalt layer is placed within two weeks of completion of base course.
2. Traffic is not routed over completed base before paving.
3. Construction is completed during the dry season of May through October.
4. If construction is performed during the wet season of November through April, prime coat may be omitted if no rain occurs between completion of base course and paving and the time between completion of base and paving is reduced to three days.
5. Where prime coat has been omitted and 1) rain occurs, 2) traffic is routed over base course, or 3) paving is delayed, measures shall be taken to restore base course, subbase course and subgrade to conditions that will meet specifications, as directed by the Owner.
6. Adjust manhole frames and covers and water valve box covers, as required, to meet final grades.
7. Receipt of asphaltic concrete materials:
 - a. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees F.
 - b. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50 degrees F and falling, nor during fog, rain, or other unsuitable conditions.
8. Spreading:
 - a. Spread material in a manner which requires the least handling.
 - b. Where thickness of finished paving will be 3 inches or less, spread in one layer.
9. Rolling:
 - a. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the Drawings.
 - b. Roll in at least two directions until no roller marks are visible.
 - c. Finished paving smoothness tolerance:

- 1) Free from birdbaths.
- 2) No deviations greater than 1/8-inch in six feet.

10. Where shown on the Plans, asphalt concrete berms shall be constructed per the detail on the Plan.

3.05 FLOOD TEST

- A. Prior to application of seal coat, perform a flood test in the presence of the Owner.
- B. Method:
 1. Flood the entire asphaltic concrete paved area with water by use of a tank truck or hoses.
 2. If a depression is found where water ponds to a depth of more than 1/8-inch in six feet, fill or otherwise correct to provide proper drainage.
 3. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.

3.06 APPLICATION OF SEAL COAT (WHERE SHOWN ON DRAWINGS)

- A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations.
- B. Apply one coat of the specified sealer to the finished asphalt pavement surface.
- C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

3.07 PROTECTION

Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

PART 4 - PAYMENT

Payment of the work in this section will be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION - 02513

SECTION 02578

PAVEMENT REMOVAL AND REPLACEMENT

PART 1 – GENERAL

1.01 Description

- A. This section describes materials, testing, removal, and replacement of asphalt concrete pavement, seal coat, aggregate base course, prime coat, tack coat, and Portland cement concrete surfaces.
- B. Jurisdictional agency permits, where applicable, shall supersede this section.

1.02 Related Work Specified Elsewhere

- A. Trenching, Backfilling, and Compacting: 02223.

1.03 Submittals

- A. Shop drawings shall be submitted in accordance with Section 01300 and the following.
- B. Submit information on material sources, designs, and quality certifications.

PART 2 - MATERIALS

2.01. Asphalt Concrete Paving

- A. Asphalt concrete paving shall be Type III-C2-AR-4000 as listed in Section 400-4 of the Standard Specifications for Public Works Construction for dense grade paving.

2.02. Asphalt

- A. Asphalt shall be viscosity grade AR 4000. Asphalt content in the pavement shall be 5.5% to 6.5%.

2.03. Aggregate for Asphalt Concrete

- A. Aggregate shall be in accordance with Sections 400-1.1 and 400-1.2 of the Standard Specifications for Public Works Construction.

2.04. Seal Coat

- A. Seal coat shall be SS1 asphaltic emulsion.

2.05. Aggregate Base Course

- A. Aggregate base shall be crushed aggregate base as specified in Section 400-2 of the Standard Specifications for Public Works Construction.

2.06. Prime Coat

- A. All aggregate base areas to be paved over shall receive prime coat. Prime coat shall be medium curing (MC-70) in accordance with Section 203-2 of the Standard Specifications for Public Works Construction.

2.07. Tack Coat

- A. Tack coat shall conform to Section 302-5.3 of the Standard Specifications for Public Works Construction.

PART 3 - EXECUTION

3.01. Pavement Removal

- A. Asphalt Concrete Pavement Cutting Requirements: Asphalt concrete pavement shall initially be cut with a pavement cutter or other equipment at the limits of the excavation before the pavement is removed. After backfilling and compacting the excavation, asphalt concrete pavement shall be saw cut to a minimum depth of 2-inches at a point not less than 9-inches outside the limits of the excavation or the previous pavement cut, whichever is greater, and the additional pavement removed. If the cut is within 3-feet of an existing joint or curb and gutter, the asphalt concrete pavement shall be replaced to the joint or curb and gutter.
- B. Portland Cement Concrete Pavement Cutting Requirements: Concrete pavement, cross gutters, curbs and gutters, sidewalks, or driveways, shall be saw cut to a minimum depth of 1-1/2-inches at a point 1-foot beyond the edge of the excavation and the strip of improvement removed. Concrete pavement may initially be cut at the limits of the excavation by other methods prior to removal and the saw cut made after backfilling the excavation. If the saw cut falls within 3-feet of a concrete joint or pavement edge, the concrete shall be removed and replaced to the joint or edge.
- C. Disposal of Material: All pavement and other improvements removed shall be disposed of off the site. The cost of such disposal shall be included in the appropriate bid item.
- D. Final Pavement Saw Cuts: Final pavement saw cuts shall be straight along both sides of the trench, parallel to the pipeline alignment, and provide clean, solid, vertical faces free from loose material. Adjoining pavement which has been damaged or disturbed shall also be saw cut and removed. Saw cuts shall be parallel to the pipeline alignment or the roadway centerline or perpendicular to same.

3.02. Pavement Replacement

- A. General: Producing, hauling, placing, compacting, and finishing of asphalt concrete shall conform to Section 302-5 of the Standard Specifications for Public Works Construction. Seal coat shall be applied to all new asphalt concrete paving, except open grade asphalt concrete.
- B. Base Course, Final Course and Striping: Base course paving shall be complete at all times to a point not to exceed 1,000 feet behind any working heading. The final asphalt surface course shall be at least 1-inch thick and shall be placed within a period of two weeks after traffic has been returned to that portion of the street. Temporary striping shall be applied after the base course of asphalt concrete pavement has been placed, in the same configuration as the existing permanent striping, so that traffic can be returned to normal patterns. Temporary striping shall be maintained until permanent striping is applied.

3.03. Preparation of Subgrade

- A. Subgrade shall be excavated and shaped to line, grade, and cross section. The top 18- inches of subgrade shall be removed and recompact to 95% relative compaction. All soft material disclosed by the compacting effort shall be removed and replaced. The finished subgrade shall be within a tolerance of +/-0.08 of a foot of the grade and cross section shown, smooth and free from irregularities and at the specified relative compaction. The subgrade shall be considered to extend over the full width of the aggregate base course.

3.04. Placing Aggregate Base

- A. Aggregate base shall be placed to thickness shown on the plans, to match existing, or per the applicable permit. Aggregate base shall be compacted to 95% relative compaction and installed in accordance with Section 301-2 of the Standard Specifications for Public Works Construction.

3.05. Placing Prime Coat

- A. Prime coat shall be applied to the surface of the final aggregate base course at the rate of 0.25 gallon per square yard per Section 302-5.3 of the Standard Specifications for Public Works Construction.

3.06. Placing Tack Coat

- A. Tack coat shall be applied at the rate of 0.05 gallons per square yard to the surfaces to receive finish pavement per Section 302-5.4 of the Standard Specifications for Public Works Construction. Tack coat shall be applied to existing asphalt, metal, or concrete surfaces that will be in contact with new asphalt concrete paving.

3.07. Placing Asphalt Paving

- A. Asphalt paving shall be applied to the thickness shown on the plans, as listed above, or per the applicable permit. Asphalt paving shall be installed in accordance with Section 302-5 of the Standard Specifications for Public Works Construction.

3.08. Applying Seal Coat

- A. Seal coat shall be applied at the rate of 0.05 to 0.10 gallon per square yard.

3.09. Compaction of Base and Leveling Courses

- A. Compaction and rolling of base and leveling courses shall begin at the outer edges of the surfacing and continue toward the center. Water shall be applied uniformly throughout the material to provide moisture for obtaining the specified compaction. Each layer shall be compacted to the specified relative compaction before the next layer is placed.

3.010. Surface Tolerance

- A. Finished grade shall not deviate more than 0.02 foot in elevation from the grade indicated on the drawings. Slopes shall not vary more than 1/8-inch in 10 feet from the slopes shown on the drawings.

3.011. Concrete Curbs, Gutters, and Sidewalks

- A. Concrete curbs, gutters, and sidewalks shall be replaced in accordance with SSWC Latest Edition.

3.012. Emulsion-Aggregate Slurry

- A. Certain street sections where shown on the plans or where required by the jurisdictional agency may be required to receive an asphaltic slurry seal in conformance with Section 302-4, Standard Specifications for Public Works Construction after the final asphalt surface course. The composition and aggregate grading for slurry shall be Type II of Subsection 203-5.3.

END OF SECTION 02578

SECTION 02640

PLASTIC PIPE

PART 1 - GENERAL

1.01 THE REQUIREMENT:

- A. The Contractor shall furnish and install all PVC and polyethylene plastic pipe, fittings, transitions, connections and appurtenant work, complete and in accordance with the requirements of the Contract Documents. The Contractor has choice of pipe material shown in the drawings. Where pipe material is specifically called for in the drawings, Contractor shall use such pipe as specified.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. Earthwork. Section 02200
- B. Water Pipeline Testing. Section 15042

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

A. Commercial Standards:

ASTM D 1784 and ASTM D 1785	Specifications for Polyvinyl Chloride (PVC) Plastic Pressure Pipe
ASTM D 3034	Specifications for Polyvinyl Chloride (PVC) Plastic Gravity Sewer Pipe
ASTM D 2321	Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

1.04 CONTRACTOR SUBMITTALS:

- A. Contractor shall submit copies of the manufacturer's product specifications according to the requirements of Section 01300 entitled, "Contractor Submittals".

PART 2 - PRODUCTS

2.01 PVC (POLYVINYL CHLORIDE) PRESSURE PIPE, 8-INCHES AND SMALLER, SOLVENT WELDED

- A. PVC pressure pipe 8-inches and smaller shall be made from all new rigid un-plasticized polyvinyl chloride and shall be Normal Impact Class 12454-B, Schedule 40, to conform to ASTM D 1785, unless otherwise shown. Elbows and tees shall be of the same material and schedule as the pipe. Unless otherwise shown, joint design shall be for solvent-welded construction. Pressure pipe shall be as follows:
- B. Pipe shall meet the requirements of AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 12-Inch with maximum DR of 18.
- C. Provisions must be made for expansion and contraction at each joint with an elastomeric seal.
- D. The bell shall consist of an integral thickened wall section with an elastomeric seal. The wall thickness in the bell section shall conform to the requirements of Section 6.2 of ASTM D3139, "Standard Specification for Joint for Plastic Pressure Pipes Using Flexible Elastomeric Seals."

- E. When used for potable water systems, pipe shall meet the requirements of ANSI/NSF 61 “Drinking Water System Components – Health Effects.”
- F. The pipe shall be manufactured to cast iron outside diameters (CIOD) in accordance with AWWA C900.
- G. The seal shall meet the requirement of ASTM F477 “Standard for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.”

2.02 (DELETED)

2.03 (DELETED).

2.04 DRAIN WASTE VENT PIPE (PVC DR35 ½” – 8”)

- A. Pipe shall be schedule 40, extruded from PVC Compound having a minimum Cell Classification 12454B as defined in ASTM D 1784. Belled end shall conform to ASTM D 2672, “Joints for PVC Pipe Using Solvent Cements”, and shall conform to ASTM D 2855.

2.06 (DELETED)

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPE:

- A. All pipe, fittings, etc. shall be carefully handled and protected against damage, impact shocks and free fall. All pipe handling equipment shall be acceptable to the Engineer. Pipe shall not be placed directly on rough ground, but shall be supported in a manner which will protect the pipe against injury whenever stored at the work site. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor.
- B. The Contractor shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Damaged pipe shall be replaced with new undamaged sections of pipe.
- C. Before placement of the pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the Work. As pipe laying progresses, the Contractor shall keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, rocks and any other debris following completion of pipe laying prior to testing, disinfecting and placing the completed pipeline in service.
- D. Pipe shall be laid directly on the imported bedding material. No blocking will be permitted and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Bell holes shall be formed at the ends of the pipe to prevent joint loading at the bells or couplings.
- E. Where necessary to raise or lower the pipe grade due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer.
- F. No pipe shall be installed upon a foundation into which frost has penetrated or any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. No pipe shall be

laid unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.

- G. Immediately before jointing bell and spigot pipe, both the bell and spigot end of the pipe shall be thoroughly cleaned and lubricated with an approved vegetable-based lubricant. The spigot end of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper alignment. Tilting of the pipe to insert the spigot into the bell will not be permitted.
- H. Solvent-welded and heat-fused joints shall be carefully and thoroughly cleaned immediately before jointing the pipe. Particular care shall be taken in making solvent-welded joints to ensure a uniform, homogeneous and complete bond.

END OF SECTION 02640

SECTION 03100

CONCRETE FORMWORK

PART 1 – GENERAL

1.01. Description – This section describes materials and installation of concrete forms.

1.02. Related Specification Sections

- A. Concrete Reinforcement: 03201.
- B. Concrete: 03300.
- C. Concrete Finishing and Curing: 03345.

1.03. Submittals

- A. Shop drawings shall be submitted in accordance with Section 01300 and the following.
- B. Submit manufacturer's literature for form ties, spreaders, corner form, form coating, and bond breakers.

PART 2 - MATERIALS

2.01. Form Construction and Design

- A. General: Forms shall be designed according to the applicable portions of ACI347, "Recommended Practice for Concrete Formwork," and all applicable regulations and codes. All concrete shall be formed unless specified otherwise.
- B. Observation Points: Form windows or stage forms shall be provided to allow observation at all times before concrete is poured. Formwork and placement design shall be such as to limit free fall of concrete to 4 feet.
- C. Notification: The Owner's Representative shall be notified a minimum of one day prior to concrete placement.

2.02. Classes of Forms

- A. Class I Forms: Smooth-surface plywood $\frac{3}{4}$ -inch minimum thickness shall be used for straight surfaces and $\frac{1}{2}$ -inch minimum thickness for curved surfaces.
- B. Class II Forms: Forms shall be made of plywood in good condition, metal, or smooth-planed boards free from large or loose knots with tongue and groove or ship lap joints. Forms shall be oiled.
- C. Application: Class II forms shall be used for exterior concrete surfaces which are 1 foot or more below finished grade. Class I forms shall be used for all other surfaces.

2.03. Form Material

- A. General: Forms shall be made of plywood, lumber, or steel of sufficient strength and surface smoothness to produce the specified finish. Joints, gaps, and apertures in forms shall be taped, gasketed, plugged and/or caulked so that the joint will remain watertight

and withstand placing pressures without bulging outward or creating surface irregularities.

- B. Lumber: Lumber used in form construction shall be standard grade Douglas fir, S4S Standard Grading and Dressing Rules No. 16, West Coast Lumber Inspection Bureau. Boards in contact with concrete shall be 6 inches or more in width.
- C. Plywood: Plywood used in form construction shall be Grade B-B, Class 1 plyform, mill-oiled, and sanded on both sides in conformance with U.S. Product Standard PS-1.

2.04. Form Ties

- A. General: Form ties shall be located on exposed surfaces in a uniform pattern or as indicated on the drawings. Form ties shall be constructed so that the tie remains embedded in the wall except for a removable portion at each end. Form ties shall have conical or spherical type inserts with a maximum diameter of 1 inch. Form ties shall be constructed so that no metal is within 1 inch of the concrete surface when the forms, inserts, and tie ends are removed. Wire ties shall not be used. Ties shall withstand all pressures and limit deflection of forms to acceptable limits.
- B. Flat Bar Ties: Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1-inch and sufficient dimensions to permit patching of the tie hole.
- C. Ties with Integral Waterstops: Ties for water-holding structures or dry structures with access, such as basement access shafts or pipe galleries that are below finish grade shall have an integral steel waterstop that is tightly and continuously welded to the tie. The waterstop shall be at least two times larger in area than the tie cross-sectional area and shall be oriented perpendicular to the tie and symmetrical about the center of the tie. Ties shall be constructed to provide a positive means of preventing rotation or disturbance of the center portion of the tie during removal of the ends.
- D. Tapered Form Ties: Tapered form ties shall be tapered through-bolts at least 1 inch in diameter at smallest end, or through-bolts that utilize a removable tapered sleeve of the same minimum size.

2.05. Bond Breaker

- A. Bond breaker shall be a nonstaining type which will provide a positive bond prevention, such as Williams Tilt-Up Compound, as manufactured by Williams Distributors, Inc., Seattle, Washington; Silcoseal 77, as manufactured by SCA Construction Supply Division, Superior Concrete Accessories, Franklin Park, Illinois; or approved equal.

2.06. Form Release Agent

- A. Form release agent shall effectively prevent absorption of moisture and prevent bond with the concrete. Agent shall be nonstaining and nontoxic after 30 days.
- B. For steel forms, release agent shall prevent discoloration of the concrete due to rust.

PART 3 - EXECUTION

3.01. Form Tolerances

- A. Rejected Work: Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner.
- B. Allowable Tolerances: The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

	Maximum Tolerance
Sleeves and inserts	1/4" - 1/4"
Projected ends of anchors	1/4" - 0.0"
Anchor bolt setting	1/4" - 1/4"
Finished concrete, all locations	1/4" - 1/4", 10 feet
Finished concrete, total length	+1"

The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and inserts: Centerline of sleeve or insert.

Projected ends of anchors: Plane perpendicular to the end of the anchor as located on the drawings.

Anchor bolt setting: Centerline of anchor bolt.

Finish concrete: The concrete surface as located on the drawings.

Where equipment is to be installed, the manufacturer's tolerances shall be complied with if more stringent than the above.

3.02. Form Surface Preparation

- A. Cleaning: Form surfaces to be in contact with the concrete shall be cleaned of all previous concrete, dirt, and other surface contaminants prior to preparation by the applicable method below.
- B. Release Agent: Wood surfaces and steel surfaces in contact with the concrete shall be coated with a release agent prior to form installation. Release agent shall be submitted to and approved by the Owner prior to construction. For water storage facilities, a non-hazardous mineral oil type release agent shall be used.

3.03. Chamfers

- A. General Dimensions: 3/4-inch bevels shall be formed at concrete edges except those on top of walls and elevated slabs and beams. Edges at top of walls, slabs, and beams shall be rounded to a 3/4-inch radius.
- B. Exterior Corners: Exterior corners in concrete members shall be provided with 3/4-inch chamfers. Reentrant corners in concrete members shall not have fillets, unless otherwise shown on the drawings.

3.04. Form Placement

- A. General: Forms shall be provided with adequate means for holding adjacent edges and

ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. The forms shall be tight and braced in order to prevent movement and the loss of mortar and fines during placing and vibration of the concrete.

- B. Inspection Openings: Cleanout and inspection openings shall be provided at the bottom of each lift of forms. There shall be one 12-inch-wide by 18-inch- high opening every 7 feet at the bottom of each lift of forms.
- C. Allowable Embedment of Form Tie in Concrete: No part of any form-tying device other than metal shall be embedded in the concrete.
- D. Taper Tie Orientation: The large end of taper ties shall be located on the "wet" side of the wall.
- E. Prevention of Spalling: Only form or form-tying methods which do not cause spalling of the concrete upon form stripping or tie removal shall be allowed.
- F. Non-formed Concrete: Surfaces of concrete members shall be formed except where placement of the concrete against the ground is shown on the drawings. The dimensions of concrete members shown on the drawings shall apply to formed surfaces, except where otherwise indicated. At least 2 inches of concrete shall be added where concrete is placed against trimmed undisturbed ground in lieu of forms. Placement of concrete against the ground shall be limited to footings and only where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing.

3.05. Form Reuse

- A. Only forms which maintain a uniform surface texture on exposed concrete surfaces shall be used. Light sanding shall be applied between uses to obtain uniform texture. Unused tie rod holes with corks, shaved flush, and sandpapered on the concrete surface side. Other than filling tie rod holes, forms shall not be patched except in the case of Class II forms. Metal patching discs shall not be used on Class I forms.

3.06. Form Removal and Timing

- A. Protection of Concrete Surfaces: Means shall be provided for removing forms without injury to the surface of the finished concrete.
- B. Form Placement Duration: Forms and shoring for elevated structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Supports shall not be removed and reshored. The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing shall be removed:

Sides of footings and encasements	24 hours
Walls not supporting load	48 hours
Vertical sides of beams, girders, and similar members	48 hours
Slabs, beams, and girders	10 days (forms only)
Shoring for slab, beams, and girders	Until concrete strength reaches specified 28-day strength
Wall bracing	Until top or roof slab concrete reaches 2,500 psi

- C. Form Placement Duration in Cold Weather: Forms shall not be removed from concrete which has been placed with outside air temperature below 50° F without first determining if the

concrete has properly set without regard for time. Heavy loading shall not be applied to green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

3.07. Formed Openings

- A. Openings shall be of sufficient size to permit final alignment of the items within it without deflection or offsets of any kind and to allow space for packing where the items pass through the wall to ensure watertightness around openings so formed. Openings shall be provided with continuous keyways with waterstops where required, and a slight flare to facilitate grouting and the escape of entrained air during grouting. Formed openings shall be provided with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2-inches clear from the opening.

3.08. Embedded Items

- A. Anchor bolts and other embedded items shall be set accurately and held securely in position in the forms until the concrete is placed and set. All special castings, channels, or other metal parts that are to be embedded in the concrete shall be checked prior to and again after concreting. All nailing blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work shall be checked prior to concreting.

3.09. Pipes and Wall Spools Cast in Concrete

- A. Fittings Cast in Formed Concrete Structures: Wall spools, wall flanges, and wall anchors shall be installed before placing concrete. Wall spools or anchors shall not be welded, tied, or otherwise connected to the reinforcing steel.
- B. Pipe Encasement: Pipe and fabricated fittings to be encased in concrete shall be supported on concrete piers or pedestals. Concrete supports shall be carried to firm foundations so that no settlement occurs during construction.

END OF SECTION 03100

SECTION 03201

CONCRETE REINFORCEMENT

PART 1 – GENERAL

1.01. Description – This section describes materials, testing, and installation of reinforcing steel for concrete.

1.02. Related Work Specified Elsewhere

- A. Concrete Formwork: 03100.
- B. Concrete: 03300.

1.03. Submittals

- A. Shop drawings shall be submitted in accordance with Section 01300 and the following.
- B. Submit mill test certificates identifying chemical and physical analyses of each load of reinforcing steel delivered. If mill test reports are unavailable and the quantity of steel for a structure exceeds 5 tons, then provide a laboratory test to prove yield strength and bending.
- C. Submit bending lists and placing drawings for all reinforcing steel. Each bending list submitted shall be complete, including corner bars as required. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown on the plans and as may be specified elsewhere in the contract documents.

PART 2 – MATERIALS

2.01. Reinforcing Steel

- A. General Requirements: Reinforcing steel shall be new material conforming to ASTM A 615, Grade 60, and shall be fabricated in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute. Reinforcing steel shall be bent while cold.
- B. Delivery: Reinforcing steel shall be delivered to the site bundled and with identifying tags.

2.02. Welded Wire Fabric

- A. Welded wire fabric shall conform to ASTM A 185. The minimum gauge of the welded wire fabric shall be 6 x 6 – W1.4 x W1.4. The welded wire fabric shall be determined by the Engineer and approved by the Owner.

2.03. Tie Wire

- A. Tie wire shall be 16 gage minimum, black, soft annealed.

2.04. Bar Supports

- A. Bar supports in beams and slabs exposed to view after form stripping shall be galvanized or plastic coated. Concrete supports shall be used for reinforcing in concrete placed on grade.

PART 3 – EXECUTION

3.01. Placing

- A. General: Reinforcing steel shall be placed in accordance with ACI and the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.
- B. Cleaning: Reinforcing steel, before being positioned, shall be free from loose mill and rust scale and from any coatings that may destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement steel shall be cleaned by abrasive sandblasting to remove mortar, oil, dirt, excessive mill scale, scabby rust, and coatings of any character that would destroy or reduce the bonding capability.
- C. Bending: Reinforcing steel shall not be straightened or reshaped in a manner that will injure the material. Bars with bends not shown on the drawings shall not be used.
- D. Reinforcing Steel Positioning: Reinforcing steel shall be positioned in accordance with the drawings and secured by using annealed wire ties or clips at inter-sections and support by concrete or metal supports, spacers, or metal hangers. Metal clips or supports shall not come in contact with the forms. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage. Bars in addition to those shown on the drawings, which may be found necessary or desirable for the purpose of securing reinforcement in position, may be provided, at no additional expense to the Owner.
- E. Clearance and Cover: Reinforcing steel shall be placed a minimum of 2 inches clear of any metal pipe or fittings. Unless otherwise indicated on the Plans, reinforcement shall be placed so as to provide the thickness of protective concrete covering as indicated on the Typical Details. If not indicated on the Plans or Standard Drawings, protective covering shall be in accordance with ACI 318.

3.02. Splices

- A. Unless otherwise shown, splices in adjacent horizontal bars shall be staggered 48 bar diameters.

END OF SECTION 03201

SECTION 03300

CONCRETE

PART 1 – GENERAL

1.01. Description – This section describes materials, mixing, and placing of concrete and grout.

1.02. Related Work Specified Elsewhere

- A. Concrete Formwork: 03100.
- B. Concrete Reinforcement: 03201.
- C. Concrete Finishing and Curing: 03345.
- D. Standard Specifications for Public Works Construction.

1.03. Submittals

- A. Shop drawings shall be submitted in accordance with Section 01300, ACI 318, and the following.
- B. Mix design with proof of design by laboratory 7-day and 28-day compressive tests, or test reports of 7-day and 28-day compressive tests of the mix where the same mix was used on two previous projects, shall be submitted in writing for review by the Owner at least 15 days before placing of any concrete.
- C. Certificate that cement used in the concrete complies with ASTM C 150 and these specifications shall be submitted to the Owner.
- D. Aggregates: Certificate of compliance with ASTM C 33 shall be provided. Weathering region limits of coarse aggregates: severe, moderate, or negligible shall be stated. Basis of determining that potential reactivity is negligible shall be stated.
- E. Ready Mix Concrete: Delivery tickets or weighmasters certificate per ASTM C 94, including weights of cement and each size aggregate, volume of water in the aggregate, and volume of water added at the plant shall be provided. The volume of water added on the job shall be written on the ticket or certificate.
- F. Concrete admixtures: Manufacturer's certificate of compliance with these specifications shall be provided.
- G. Epoxy Bonding Compound: Manufacturer's specific instructions for use shall be provided.
- H. Nonshrink Grout: Manufacturer's certificate of compliance with these specifications and specific instructions for use shall be provided.

PART 2 – MATERIALS

2.01. Cement

- A. Cement shall conform to ASTM C 150, Type II or Type V, with maximum tricalcium aluminate not to exceed 6%. The maximum percent alkalis shall not exceed 0.6%.

2.02. Aggregates

- A. Aggregates shall comply with ASTM C 33 and shall be free from any substances that will react with the cement alkalis.

2.03. Water and Ice

- A. Water and ice that is clean and free from objectionable quantities of organic matter, alkali, salts, and any other impurities which might reduce the strength, durability, and quality of the concrete shall be used in the concrete mix.

2.04. Color Additive

- A. For exterior electrical duct concrete encasements, a color additive shall be used for identification purposes: Color additive shall be: brick red "Colorfull," as manufactured by Owl Manufacturing Company, Arcadia, California; coral red "Chromix C-22," as manufactured by L. M. Scofield Company, Los Angeles, California; or approved equal. The color additive shall be added while the concrete is being mixed using the quantity per cubic yard of concrete recommended by the manufacturer for the class of concrete indicated.

2.05. Concrete Admixtures

- A. Air Entraining Admixture: Concrete may contain an air-entraining admixture which shall conform to ASTM C 260, except it shall be nontoxic after 30 days and shall contain no chlorides. Admixture shall be Master Builders MB-VR, Sika AER (Sikamix 104), or approved equal.
- B. Water Reduction Admixture: Concrete may contain a water-reducing admixture which shall conform to ASTM C 494, Type A or Type D, except it shall contain no chlorides, shall be nontoxic after 30 days, and shall be compatible with the air-entraining admixture. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Admixture shall be Master Builders Pozzolith polymer-type normal setting, Plastocrete (Sikamix 160) Normal Set, S i k a C h e m i c a l Corporation, or approved equal.
- C. Restrictions: Accelerating water-reducing admixtures or any other type of admixture that contains chlorides or other corrosive elements shall not be used in any concrete.

2.06. Nonshrink Grout

- A. Nonshrink grout shall conform to the Corps of Engineers Specification for Nonshrink Grout, CRD-C588-78, and to these specifications. Use a non-gas-liberating type, cement base, premixed product requiring only the addition of water for the required consistency. Grout shall be UPCON High Flow, Master Flow 713, or approved equal. All components shall be inorganic.

2.07. Ordinary Type Grout (Dry Pack)

- A. Ordinary type grout shall consist of one part portland cement to two parts sand (100% passing a No. 8 sieve). Sufficient water shall be added to produce damp formable consistency.

2.08. Epoxy Bonding Compound

- A. Manufacturer's certifications as to suitability of product to meet job requirements with regard to surface, pot life, set time, vertical or horizontal application, and forming restrictions shall be provided. Bonding compound shall be Concessive 1001 LPL, Adhesive Engineering Company, San Carlos, California; Sikadur Hi-Mod (Sikastix 370), Sika Chemical Corporation, Lyndhurst,

New Jersey; or approved equal.

2.09. Concrete Mix Design

- A. General: Concrete mix design shall conform to ASTM C 94 and ACI 318, except as modified by these specifications.
- B. Fly Ash: Fly ash shall not be used in the mix as a partial substitute for cement.
- C. Air Content: Air content as determined by ASTM C 231 shall be 4% +/-1%.
- D. Water-Cement Ratio: Maximum water-cement ratio for Class A concrete shall not exceed 0.44 by weight.
- E. Classes: Classes of concrete shall be used as described on the plans:

Class	Type of Work	28-Day Compressive Strength (psi)	Minimum Cement Content (lbs. per C.Y.)
A	Structures (all) Curbings Sidewalks Unspecified by Plans	3,500	564 = 6 sk.
B	Where shown on plans	2,500	470 = 5 sk.
C	Fill for structure foundations, cradles, supports across pipe trenches, anchors, and miscellaneous unreinforced concrete	2,000	376 = 4 sk.

- F. Slump: Slump shall be measured in accordance with ASTM C 143. Slump shall be as follows:
 - 1. 3 inches maximum for Slab on grade or heavy sections wider (in plan view) than 3 feet
 - 2. 4 inches maximum for Footings, walls, suspended slabs, beams, and columns
 - 3. Concrete shall be proportioned and produced to have a maximum slump as shown. A tolerance of up to 1 inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than specified slump may be used provided it is properly placed and consolidated.
- G. Aggregate Size: Aggregate size shall be ¾-inch maximum for slabs and sections 8 inches thick and less. Aggregate size shall be 1½ inches maximum for all larger slabs and sections. Combined aggregate grading shall be as shown in the following table:

Maximum Aggregate Size – Percentage Passing		
Sieve Sizes	1-1/2"	3/4"
2"	100	--
1-1/2"	90 – 100	--
1"	50 – 86	100
3/4"	45 – 75	90 – 100
3/8"	38 – 55	60 – 80
No. 4	30 – 45	40 – 60
No. 8	23 – 38	30 – 45
No. 16	17 – 33	20 – 35
No. 30	10 – 22	13 – 23
No. 50	4 – 10	5 – 15
No. 100	1 – 3	0 – 5
No. 200	0 – 2	0 – 2

- H. Pumped Concrete Design Mix: Mix design for pumped concrete shall produce a plastic and workable mix. The percentage of sand in the mix shall be based on the void volume of the coarse aggregate.

2.01. Workability

- A. General: Concrete shall be of such consistency and composition that it can be worked readily into the forms and around the reinforcement without excessive spading and without permitting the materials to segregate or free water to collect on the surface. The proportions shall be adjusted to secure a plastic, cohesive mixture, and one which is within the specified slump range.
- B. Aggregate: To avoid unnecessary changes in consistency, aggregate shall be obtained from a source with uniform quality, moisture content, and grading. Materials shall be handled in such a manner that variations in moisture content will not interfere with production of concrete of the specified degree of uniformity and slump.

PART 3 - EXECUTION

3.01. Site-Mixed Concrete

- A. General: Site-mixed concrete shall conform to ACI 304 as modified by these specifications.
- B. Batching and Mixing Equipment: A batch-type mixer shall be used that is capable of combining the aggregates, cement, and water within the specified time into a thoroughly mixed and uniform mass and discharging the mixture without segregation. Supporting equipment shall be used that can accurately proportion the cement, the coarse and fine aggregates, the admixtures, and the water which enters the mixing drum. Cement and aggregate shall be proportioned by weight. Each entire batch shall be discharged before recharging. The volume of the mixed materials per batch shall not be allowed to exceed the manufacturer's rated capacity of the mixer.
- C. Mixing Time: Mixing time shall be as follows:
1. For mixer of a capacity of 1 cubic yard or less, one and one-half minutes after batching is completed.
 2. For mixers of capacities larger than 1 cubic yard, one and one-half minutes plus one-half minute for each additional 1/2-cubic-yard capacity or fraction thereof in excess of 1 cubic yard.

3. The mixer shall revolve at a uniform rate as specified by the manufacturer for the mixing equipment.

3.02. Ready-Mixed Concrete

- A. General: Ready-mixed concrete shall conform to ASTM C 94 as modified by these specifications.
- B. Haul Time Requirements: The haul time of ready-mixed concrete shall be limited so that the specified slump is attained without the onsite addition of water, which may cause the mix design water-cement ratio to be exceeded. When haul time is excessive, truck-transported, dry-batched concrete shall be used and mixed on the jobsite. Partially hardened concrete shall not be retempered.

3.03. Placing Concrete

- A. General: Concrete placement shall conform to ACI 304 as modified by these specifications.
- B. Placement Sequence: The sequence of concrete placement shall be coordinated in advance of actual placement to assure that construction joints will occur only as designed. The Owner's Representative shall be furnished a copy of the sequence of placement in advance of actual placement. Alternate sections of concrete walls and slabs shall be placed monolithically. Concrete for walls and slabs shall not be placed until seven days after placement of concrete for adjacent walls and slabs.
- C. Notification: The Owner's Representative shall be notified of readiness, not just intention, to place concrete in any portion of the work. This notification shall be such time in advance of the operation as the Owner's Representative deems necessary for him to observe the preparations at the location of the proposed concrete placing. All forms, steel, screeds, anchors, ties, inserts and other items to be embedded shall be in place before notification of readiness is given to the Owner's Representative.
- D. Equipment Readiness: Sufficient primary and backup equipment shall be scheduled for continuous concrete placement, and anticipate what actions will be taken during interruption. Extra concrete vibrators shall be provided. Concrete vibrators shall be tested the day before placing concrete.
- E. Removal of Water from Areas to Receive Concrete: Concrete shall not be placed until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes or other means and carried out of the forms, clear of the work. Concrete shall not be placed underwater, nor shall still water be allowed to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the newly deposited concrete in such manner and of such velocity that will damage the surface finish.
- F. Moisture Barriers: Where a moisture barrier is installed, the moisture barrier shall not be punctured by stakes or any other concrete accessories.
- G. Concrete Pours and Freefall: Concrete shall be deposited at or near its final position to avoid segregation caused by rehandling or flowing. Concrete shall not be deposited in large quantities in one place to be worked along the forms with a vibrator. Concrete shall not be dropped freely into place from a height greater than 4 feet. Tremies shall be used where the drop could exceed these limits.
- H. Consolidation of Concrete: Mechanical vibrators shall be used while placing concrete to

eliminate rock pockets and voids, to consolidate each layer with that previously placed, to completely embed reinforcing bars and fixtures, and to bring just enough fine material to exposed surfaces to produce a smooth, dense, and even texture. Vibrators shall be of the high-frequency internal type, and the number in use shall be able to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases, at least two vibrators shall be available at the site. External vibrators shall be used for consolidating concrete only when the concrete is otherwise inaccessible for adequate internal consolidating.

- I. Protection of Concrete: Concrete shall not be placed during wet weather events. Concrete placed immediately before rain shall be protected to prevent rainwater from coming in contact with it. Sufficient protective covering shall be kept on hand at all times for this purpose.

3.04. Concrete Tests

- A. General: Strength tests shall be performed on the concrete by the Owner's Representative as follows:
 1. Mold and cure three concrete test cylinders from each 50 cubic yards, or fraction thereof, of each class of concrete placed in any one day. Mold and cure the cylinders in accordance with ASTM C 31.
 2. Test cylinders in accordance with ASTM C 39. Test two cylinders at 28 days for acceptance, and test one at 7 days for information. The test results shall be the average of the strengths of the two cylinders tested at 28 days. If one cylinder in a test manifests evidence of improper sampling, molding, or testing, other than low strength, discard it and use the strength of the remaining cylinder for the test result. Should both cylinders in a test show any of the above defects, discard the entire test.
 3. Determine slump of the concrete using ASTM C 143 for each strength test sample and as required to establish consistency.
 4. Determine air content of the concrete using ASTM C 231 for each strength test sample and as required to establish consistency.
- B. Notification and Handling of Samples: To facilitate testing and inspection:
 1. The Owner shall be advised in advance of concrete placing operations to allow for completion of quality tests.
 2. Labor necessary to assist the Owner Representative in obtaining and handling samples at the project shall be furnished by the Contractor.
 3. Facilities for safe storage and proper curing of concrete test specimens on the project site, as required by ASTM C 31 shall be provided and maintained by the Contractor for the sole use of the Owner.
- C. Requirements for Attainment of Compressive Strength: Concrete specified by compressive strength shall attain the 28-day strength specified in Part 2, Paragraph I of this section. The average of any three consecutive strength tests shall be equal to or greater than the specified 28-day strength. Not more than 10% of the tests shall be less than specified 28-day strength. No test shall be less than 85% of the specified 28-day strength.
- D. Failure to Attain Specified Strength: If the 28-day tests fail to meet the specified minimum compressive strength, the concrete will be assumed to be defective and one set of three cores from each area may be taken as selected by the Owner and in accordance with

ASTM C 42. If the average compressive strength, of the set of three concrete cores fails to equal 85% of the specified minimum compressive strength or if any single core is less than 75% of the minimum compressive strength, the concrete will be considered defective and shall be removed and replaced, all at no cost to the Owner. Costs of coring, testing of cores, and all required repairing pertaining thereto shall be the responsibility of the Contractor.

3.05. Pumping Concrete

- A. Equipment Capacity Requirements: Pump size shall be determined by the rate of concrete placement, length of delivery pipe or hose, aggregate size, mix proportions, vertical lift, and slump of concrete.
 - 1. Minimum inside diameter of pipe or hose shall be based on the maximum aggregate size as follows:
 - i. 3/4-inch-max aggregate: 2 inches min ID
 - ii. 1-1/2-inch-max aggregate: 4 inches min ID
- B. Disallowance of Aluminum Pipe: Aluminum pipes shall not be used for delivery of concrete to the forms.
- C. Priming: Before pumping is started, the delivery pipe or hose shall be primed by pumping mortar through the line using 5 gallons of mortar for each 50 feet of delivery line. Mortar shall be pumped to waste and not deposited in the forms.

3.06. Hot Weather Requirements

- A. General: During hot weather, proper attention shall be given to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation in accordance with ACI 305 and the following. There shall be no additional reimbursement for costs incurred for placing concrete in hot weather.
- B. Cooling Methods: When the weather is such that the temperature of the concrete as placed would exceed 90°F, ice or other effective means of cooling the concrete during mixing and transportation shall be used so that the temperature of the concrete as placed will not exceed 90°F.
- C. Prevention Against Early Setting of Concrete: Precautions shall be taken when placing concrete during hot, dry weather to eliminate early setting of concrete. This includes protection of reinforcing from direct sunlight to prevent heating of reinforcing, placing concrete during cooler hours of the day, and the proper and timely application of specified curing methods.

3.07. Cold Weather Requirements

- A. General: Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather in accordance with ACI 306 and the following. There shall be no additional reimbursement for costs incurred for placing concrete during cold weather.
- B. Heated Mixing Water: When the temperature of the surrounding atmosphere is 40°F or is likely to fall below this temperature, the mixing water shall be heated to, but not exceed, 140°F. The heated water shall not be allowed to come in contact with the cement before the cement is added to the batch.

- C. Temperature Requirements: When placed in the forms during cold weather, the concrete temperature shall be maintained at not less than 55°F. All materials shall be free from ice, snow, and frozen lumps before entering the mixer.
- D. Curing Requirements: The air and the forms in contact with the concrete shall be maintained at temperatures above 40°F for the first five days after placing, and above 35°F for the remainder of the curing period. Thermometers shall be provided by the Contractor to indicate the ambient temperature and the temperature 2 inches inside the concrete surface.

3.08. Bonding to Existing Concrete

- A. Existing concrete to which new concrete is to be bonded shall have the contact surfaces coated with epoxy bonding compound. The method of preparation and application of the bonding compound shall conform to the manufacturer's printed instructions and recommendations for specific application for this project.

3.09. Grouting Machinery Foundations

- A. During placement of machinery, concrete shall be blocked out or finished off a sufficient distance below the bottom of the machinery base to provide for the thickness of grout shown on the drawings. After the machinery has been set in position and wedged to the proper elevation by steel wedges, the space between the bottom of the machinery base and the original pour of concrete shall be filled with a pourable nonshrink grout.

END OF SECTION

SECTION 03345

CONCRETE FINISHING AND CURING

PART 1 - GENERAL

1.01. Description

- A. This section describes materials and methods of concrete finishes, curing, repair of defects, and surface protection.

1.02. Related Work Specified Elsewhere:

- A. Concrete Formwork: 03100.
- B. Concrete Reinforcement: 03201.
- C. Concrete: 03300.

1.03. Submittals

- A. Shop drawings shall be submitted in accordance with Section 01300 and the following.
- B. Curing Compound: Submit manufacturer's statement of compliance with these specifications and recommended coverage to meet or exceed the specified tests. Submit manufacturer's application instructions.

PART 2 - MATERIALS

2.01. Curing Compound

- A. General: Curing compound shall conform to ASTM C 309, Type 2, Class B, and shall be compatible with required finishes and coatings.
- B. Manufacturers: Curing compound shall be: Masterseal, manufactured by Master Builders, Cleveland, Ohio; Evco Floor Coat, manufactured by Euclid Chemical Co., Cleveland, Ohio; or approved equal.

2.02. Mortar for Repair of Concrete

- A. Mortar used for repair of concrete shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one part cement to two and one-half parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing.

PART 3 - EXECUTION

3.01. Concrete Finishes

- A. Concrete surfaces shall be completed in accordance with the following schedule:

Finish Designation	Applicable Surface
F-1	Exterior walls exposed to water or groundwater, and interior of vault walls.
F-2	Walls, structures, or building walls exposed to view. Underside of formed floors or slabs.
S-1	Slabs and floors not water bearing.
E-1	Exposed edges of slabs, floors, and wall tops.
Finish F-1:	Defective concrete shall be repaired, fins removed, depressions 1/4 inch or deeper filled, and form-tie holes filled.
Finish F-2:	In addition to repairs of Finish F-1, depressions and air holes shall be opened by whip-blasting and filled with mortar. Surfaces shall be dampened and a slurry consisting of one part cement and one and one-half parts sand by damp loose volume shall be spread over the surface with clean burlap pads or sponge rubber floats. Any surplus shall be removed by scraping and then rubbing with clean burlap.
Finish S-1:	Shall be a smooth steel trowel finish.
Finish E-1:	Exposed edges of slabs, floors, and tops of walls, shall be finished with a 3/4-inch-radius edger, where chamfer is not indicated.

3.02. Finishing of Formed Surfaces

- A. Curing Requirement: Surfaces shall be water cured until finishing and repairing are completed.
- B. Repair of Surface Defects: Immediately after forms are removed, fins and irregularities shall be removed by grinding or rubbing. Depressions deeper than specified shall be filled with mortar, and form-tie holes filled.
- C. Form-tie Holes: Form-tie holes shall be reamed with toothed reamers until surface of hole is rough and clean. Surface shall be coated with epoxy bonding compound and filled with mortar. Tapered form-tie holes shall be finished as follows:
1. Form-tie holes shall be sandblasted and blown clean prior to filling.
 2. A rubber plug, with one end open, shall be driven to the center of the hole. Plug size shall be larger in diameter than the diameter of the hole at the center of the wall.
 3. The entire annular surface of the hole shall be coated with epoxy prior to filling with mortar. Epoxy shall be applied in accordance with manufacturer's instructions.
 4. Each side of hole shall be filled with mortar. Mortar shall be applied to the "wet" side of the wall first. Mortar shall be solidly consolidated into the hole.
 5. The Owner Representative shall be notified in advance of the form-tie hole filling schedule.

3.03. Repair of Surface Defects

- A. Repair Limits: Honeycombed and other defective concrete shall be removed down to sound concrete. Edges shall be perpendicular to surface. Surfaces to receive repair shall be sandblasted.
- B. Bonding Compound: Sandblasted surface shall be coated with epoxy bonding compound.
- C. Mortar Placement: Mortar shall be placed in layers having a compacted thickness of 3/8-inch. The surface of each layer shall be scratched to promote bonding with next layer. Finish repair shall match adjacent concrete and cure as specified.
- D. Repair of Large Defective Areas: Defective areas of more than 1 foot square and deeper than the reinforcing steel shall be repaired as above, with the exception that the area shall be filled with pneumatically applied concrete.

3.04. Curing

- A. Allowable Curing Methods: Concrete surfaces shall be cured by water curing or by use of sprayed curing compound at the Contractor's option. Where wooden forms are used, the forms shall be wet immediately before concreting and keep moist by sprinkling until removed. All exposed surfaces of formed concrete shall be kept moist until curing compound is applied.
- B. Curing Compound Method:
 - 1. Concrete shall be cured for not less than 14 days after placement.
 - 2. The surface shall be sprayed with two coats of liquid curing compound. Curing compound shall be applied in accordance with the manufacturer's instructions to cover the surface with a uniform film which will seal thoroughly. A second coat shall be applied at 90 degrees to the direction of spray for the first coat.
 - 3. Curing compound shall be applied immediately after completion of the finish on unformed surfaces, and within two hours after removal of forms on formed surfaces. Formed surfaces shall be repaired within the said two-hour period; provided, however, that any such repairs which cannot be made within the said two-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area shall first be sandblasted to remove the curing compound, then repaired.
 - 4. Wherever curing compound may have been applied to surfaces against which concrete subsequently is to be placed and to which it is to adhere, the curing compound shall be removed entirely by sandblasting prior to the placing of new concrete.
 - 5. Care shall be taken to avoid damaging the seal during the curing period. Damaged or broken seals shall be repaired immediately by the application of additional curing compound.

END OF SECTION 03345

SECTION 03462

PRECAST CONCRETE VAULTS AND METER BOXES FOR WATER SERVICES

PART 1 – GENERAL

1.01. Description

- A. This section describes the materials, manufacture, and installation of precast concrete vaults and meter boxes.

1.02. Related Work Specified Elsewhere

- A. Structure Earthwork: 02200
- B. Trenching, Backfilling and Compacting: 02223
- C. Concrete: 03300
- D. Structural Steel and Miscellaneous Metalwork: 05010

1.03. Submittals

- A. Shop drawings shall be submitted in accordance with Section 01300 and the following.
- B. Submit manufacturer's catalog data on precast concrete vaults and meter boxes.
- C. Show dimensions and materials of construction by ASTM reference and grade.

PART 2 - MATERIALS

2.01. Precast Concrete Vault

- A. Manufacturers: Precast concrete vaults and covers shall be manufactured in a plant especially designed for that purpose and shall conform to the size, shape and dimensions indicated on the detailed plans. Vaults and covers shall be Brooks Products, Inc., Best Concrete Products, Associated Concrete Products, or approved equal.
- B. Design Loads: Design loads shall consist of dead load, live load, impact, and in addition, loads due to water table and any other loads which may be imposed upon the structure. Live loads shall be based on H-20 loading per AASHTO standard specifications for highway bridges. Design wheel load shall be 16 kips. The live load shall be that which produces the maximum shear and bending moments in the structure.
- C. Concrete: Concrete for vaults and meter boxes units shall be Class A conforming to Section 03300, Concrete.
- D. Sectional Vaults: Sectional precast concrete vaults may be used where specified on the drawings or approved by the Owner Representative.
- E. Hinged: Diamond plate aluminum cover with spring assist and safety lock.

2.02. Precast Meter Boxes and Covers

- A. Materials: Meter boxes and covers shall be manufactured of concrete.
- B. Meter Box Covers: Meter box covers shall be manufactured of one solid concrete rectangular piece.
- C. Traffic Covers: Meter box covers within roadways or driveways shall be one lipped cast-iron or steel lid piece, designed to withstand H-20 highway loading, and may only be used where specified on the plan or approved by the Owner.
- D. Meter Box Size
 - 1. For ¾- and 1-inch Meters – Nominal inside dimensions shall be 13 3/8- inches wide x 24- inches long x 12-inches deep.
 - 2. For 1½- and 2-inch Meters – Nominal inside dimensions shall be 18½- inches wide x 30- inches long x 12-inches deep.
- E. Manufacturers: Meter boxes shall be manufactured of concrete by Eisel Enterprises, Inc.

2.03. Vault Frames and Covers

- A. Materials: Unless noted otherwise, vault frames and covers shall be fabricated of aluminum in accordance with the requirements of Section 05120, Structural Steel and Miscellaneous Metalwork.
- B. Covers: Covers shall be fabricated with supports to prevent permanent deflection.

2.04. Joint Sealing Compound

- A. The joint sealing compound shall be permanently adhesive flexible plastic material complying in every detail to Federal Specification SS-S-00210 (GSA-FSS). Joint sealing compound shall be Quickseal by Associated Concrete Products, or for contracts between Owner and Contractor, approved equal.

PART 3 – EXECUTION

3.01. Earthwork

- A. General: Excavation and backfill for precast concrete vaults and meter boxes shall be in accordance with Section 02223, Trenching, Backfilling, and Compacting, and the requirements herein. Excavation limits shall be large enough to accommodate the structure and permit grouting of openings and backfilling operations.
- B. Sub-base: The bottom of the structure shall be placed on 12-inches of compacted, crushed rock sub-base, graded level and to the proper elevation as shown on the plans and shall conform to the specifications in Section 02223, Trenching, Backfilling, and Compacting.

3.02. Vault Installation

- A. Vault Wall Openings: Openings or "knockouts" in precast concrete vaults shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or coupling flange. Upon completion of installation, all voids or openings in the vault walls around pipes shall be filled with Class A concrete or mortar, using an epoxy for bonding concrete surfaces, as specified in Section 03300, Concrete.
- B. Backfill: After the structure and all appurtenances are in place and approved, backfill shall be

placed to the original ground line or to the limits designated on the plans.

- C. Watertightness: All joints between precast concrete vault sections shall be made watertight. The sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint.
- D. Installed Elevation: Vaults shall be built up so that the cover is flush with the surrounding surface unless otherwise specified on the drawings or by the Owner Representative in the field. The Contractor is responsible for placing the cover at the proper elevation and slope where paving is to be installed, and shall make all necessary adjustments so that the cover meets these requirements.

3.03. Meter Box Installation

- A. Line and Grade: Meter boxes shall be set true to line and to the grade of the top of the curb, sidewalk, or surrounding graded area.
- B. Sequence of Installation: Meter boxes shall not be set until fine grading or landscape grading in the vicinity has been completed.

END OF SECTION 03462

SECTION 05010

STRUCTURAL AND MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of structural and miscellaneous metals.

1.02 DESIGN CRITERIA

- A. Structural Connections and Framing: AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings (Eighth Edition), except delete Section 1.1, the last sentence of Sections 1.26.1 and 1.26.3, and Part 2 in its entirety.
- B. Handrails, Walkways, Ladders, Personnel Platforms: OSHA, California State Safety Standards or UBC, whichever is more stringent.
- C. Grating, Floor Plates, and Miscellaneous Cover Plates: Minimum design live load of 150 psf, maximum deflection of 1/240 of span.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300.
- B. Submit drawings of fabricated items, such as grating, bolts, handrail, ladders, concrete anchors, and access hatches. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 – MATERIALS

2.01 MATERIALS

Unless otherwise specified or indicated on the Drawings, structural and miscellaneous metals shall conform to the standards of the American Society for Testing and Materials (ASTM), including the following:

ITEM	ASTM STANDARD NO.	CLASS, GRADE, TYPE OR ALLOY NO.
Cast Iron		
Cast Iron	A-48	Class 40B
Steel		
Galvanized Sheet Iron or Steel	A-446, A-525, A-526	Coating G90
Black Steel, Sheet or Strip	A-569, A-570	
Coil (Plate)	A-635	
Structural Plate, Bars, Rolled Shapes and Misc. Items	A-36	
Standard Bolts, Nuts and Washers	A-307	
High Strength Bolts, Nuts and Hardened Flat Washers	A-325, A-490	
Eyebolts	A-489	Type 1
Tubing, Cold Formed	A-500	Grade B
Tubing, Hot Formed	A-501	Grade
Steel Pipe	A-53	Grade B
Stainless Steel		
Plate, Sheet and Strip	A-167	Type 304 or 316
Bars and Shapes	A-276	Type 304 or 316
Aluminum		
Sheet Aluminum-Flashing	B-209	Alloy 5005-H114, 0.032 Inches Min. Thickness
Sheet Aluminum-Structural	B-209	Alloy 6061-T6
Structural Aluminum	B-308	Alloy 6061-T6
	B-209	
Extruded Aluminum	B-221	Alloy 6063-T42

Stainless Steels are Designated by Type or Series Defined by AISI.

2.02 METAL FASTENING

- A. General – Unless otherwise indicated on the Drawings or specified, metal fastening shall be as follows.
- B. Bolting
 - 1. Bolts, except high strength bolts, shall be provided with flat washers and self-locking nuts, or lock washers and nuts.
 - a. Bolt heads and nuts shall be hex-type.
 - b. Bolts, nuts, and washers shall be of domestic manufacture.
 - 2. Bolts, including anchor bolts, nuts, washers, and similar fasteners specified to be galvanized, shall be galvanized in accordance with ASTM A 153.
 - 3. After installation, bolts, including anchor bolts and concrete anchors, shall project a minimum of two threads but not more than 1/2 inch beyond the nut.
 - 4. Unless otherwise specified, bolts, including anchor bolts and concrete anchors, shall be tightened to the snug-tight condition. The snug-tight condition shall be defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.
- C. High Strength Structural Bolts
 - 1. High strength bolts, nuts, and hardened flat washers shall conform to ASTM A 325 or ASTM A 490, as indicated on the Drawings.
 - 2. Connections with high strength bolts shall be considered to be slip critical structural connections unless otherwise indicated on the Drawings. Connections with high strength bolts shall conform to the requirements of the AISC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - a. A hardened flat washer shall be provided
 - 1) Under the element, nut or bolt head, turned in tightening.
 - 2) On outer plies for short slotted holes.
 - b. Contractor shall notify Owner in advance of the method selected for tightening and verification pursuant to the referenced AISC Specification.
- D. Assembly Bolts – Bolts, nuts, and washers for field assembled construction shall be as follows:
 - 1. Type 316 stainless steel in wet and moist locations, including:
 - a. Dry side of walls of water containing structures.
 - b. Pump and equipment bases.
 - 2. Type 304 or Type 316 stainless steel:
 - a. Aluminum assemblies.
 - b. Dry or exposed sides of walls of earth supporting structures.
 - c. Buried locations.

3. Hot-dip galvanized ASTM A 307 steel for galvanized assemblies and for applications other than those specified hereinbefore.

E. Eyebolts – Eyebolts shall be Type 304 stainless steel.

2.03 FASTENERS FOR USE IN CONCRETE

A. General

Fasteners for use in concrete shall be as specified hereinafter. "Slug-in," lead cinch, and similar systems relying on the deformation of lead alloy or similar materials in order to develop holding power shall not be used.

B. Anchor Bolts

Anchor bolts shall be cast in place when concrete is placed. Anchor bolts embedded in concrete shall be accurately located and with bolts perpendicular to the surface from which they project.

Anchor bolts, nuts, and washers shall be as follows:

1. Series 300 stainless steel.

- a. Anchor bolts shall not touch reinforcing steel. Where anchor bolts are within 1/4 inch of reinforcing steel, anchor bolts shall be insulated with not less than four wraps of 10-mil PVC tape in the area adjacent to the reinforcing steel.
- b. In anchoring machinery bases subject to heavy vibration, two nuts shall be used, one serving as a locknut.
- c. Bolts, when indicated on the Drawings for future use, shall be first coated thoroughly with nonoxidizing wax, followed by turning nuts down to the full depth of thread. Exposed thread shall then be neatly wrapped with a waterproof polyvinyl tape.
- d. Anchor bolts shall be embedded not less than 10 diameters and shall have a standard hex bolt head or a 90-degree hook not less than 4 diameters in length. Where indicated on the Drawings, anchor bolts shall be set in metal sleeves having an inside diameter approximately 2 inches greater than the bolt diameter and not less than 10-bolt diameters in length. Sleeves shall be filled with grout when the machine or other equipment is grouted in place.

2.04 CONCRETE INSERTS

Concrete inserts for supporting pipe and other applications shall be as specified elsewhere in these Specifications. Unless otherwise specified, concrete inserts shall be 304 or 316 Stainless Steel.

2.05 MISCELLANEOUS METAL

A. Miscellaneous Aluminum

Structural and other metal items fabricated from aluminum, not covered separately herein shall be fabricated in accordance with the best practices of the trade and shall be field assembled by riveting or bolting with no welding or flame cutting permitted.

B. Miscellaneous Stainless Steel

All stainless steel unless noted otherwise in the Specifications or on the Plans, shall be stainless steel 316L.

C. Miscellaneous Structural Steel

Miscellaneous steel items not specified herein shall be as indicated on the Drawings or specified elsewhere in these Specifications and shall be fabricated and installed in accordance with the best practices of the trade.

2.06 SHEET METAL

A. General

Sheet metal flashing, counter flashing, fascia, gravel stops, and other roofing accessories shall be in accordance with these Specifications. Sheet metal items not covered elsewhere shall be as indicated on the Drawings and as required to provide a watertight installation. Formed sheet metal for metal covered work shall accurately reproduce the detail as indicated on the Drawings; profiles, bends, and intersections shall be sharp, even, and true.

B. Aluminum Sheet Metal Work

Except as otherwise specified or indicated on the Drawings, sheet aluminum shall be alloy 5005-H14 conforming to the requirements of ASTM B 209 and shall be not less than 0.032-inch in thickness. Extruded aluminum shall be 6063-T4, conforming to the requirements of ASTM B 221.

C. Roofing Material

Roofing material shall be 16 inch wide Standing Rib sheet metal with pencil ribs and concealed clip attachment panels over 30 pound minimum asphalt felt material. Roofing panels shall be 22 gauge galvanized metal with BASF **Ultra** Cool Kynar 500 paint finish Color selected by owner. Roofing panels shall be Nu-Ray Metals Series 1000, or approved equivalent.

PART 3 - EXECUTION

3.01 FABRICATION AND ERECTION

- A. Fabrication and erection of steel items shall conform to AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings wherever applicable, except as the same may be modified by applicable building codes and these Specifications. Where anchors, connections or other details of miscellaneous metalwork are not definitely indicated on the Drawings, or specified in the Specifications, their material, size, form, attachment, and location shall be equivalent in quality and workmanship to items specified herein.
- B. Structural members such as W shapes, S shapes, channels, angles, and similar members which are not available in the quantity, size, and type of stainless steel specified or indicated on the Drawings, shall be fabricated by welding together pieces of stainless steel plate. The stainless steel plate shall be low carbon stainless steel plate such as 316L. All welds between pieces of plate shall be full penetration welds. The fabricated members shall have the same or higher section modulus and moment of inertia as the indicated members. Submit the design of the fabricated members before fabricating of the members.
- C. Galvanized structural steel or iron shall be hot-dip galvanized after fabrication in accordance with ASTM A 123. Electro-galvanizing shall not be used unless specified. Galvanized items that bend or twist during galvanizing shall be restraightened. Cut or otherwise damaged galvanized surfaces shall be field repaired to equivalent original condition using Galvinox; Galvo-Weld; or equal.

- D. The Contractor shall take all measurements necessary to properly fit his work in the field, and he shall be governed by and be responsible for these measurements and the proper working out of all details. The Contractor shall be responsible for the correct fitting of all metalwork in the field. Sharp or hazardous projections shall be rounded off and ground smooth. The Contractor shall paint steel and miscellaneous ferrous metal items in accordance with these Specifications.
- E. Where aluminum comes in contact with dissimilar metals, except stainless steel, it shall be bolted with stainless steel bolts and separated or isolated from the dissimilar metals, with neoprene gaskets, sleeves, and washers. Those parts of aluminum which will be cast into concrete or which will be in contact with concrete, masonry, or wood shall be coated as specified elsewhere in these Specifications.
- F. The threads of stainless steel bolts shall be coated, prior to installing the nut, with Never-Seez manufactured by Never Seez Compound Corporation; WLR No. 111 manufactured by Oil Research, Inc.; or equal.

3.02 WELDING

A. General

1. Welding of structural metals shall be done by welders who have a current American Welding Society (AWS) certificate for the type of welding to be done by the welder. The Contractor shall notify the Owner at least 24 hours before starting shop or field welding. The Owner's representative may check the materials, the equipment, and the qualifications of the welders. Welders doing unsatisfactory work shall be removed from the Work, or may be required to requalify.
2. The Owner may use gamma ray, magnetic particle, dye penetrant, trepanning, or any other aid to visual inspection which he may deem necessary on any part or all welds to examine the welds.
3. The cost of retests on defective welds shall be borne by the Contractor. Cost in connection with qualifying welders shall also be borne by the Contractor.
4. Welds shall be full penetration welds unless otherwise indicated on the Drawings.

B. Welding Aluminum

1. Welding of aluminum shall be in accordance with AWS D1.2, Structural Welding Code - Aluminum. Detail requirements for welding aluminum alloy 6061-T6 shall be as specified in the following paragraphs.
2. Filler metal for welding aluminum shall be aluminum alloys conforming to the requirements of AWS A5.10 and shall be AWS classification ER 4043, ER 5654,
3. ER 5554, ER 5183, ER 5356, or ER 556.
4. Welding of structures which are to be anodized shall be done using filler alloys which will not discolor when anodized. ER 5654, ER 5554, ER 5183, ER 5356, or ER 5556 filler alloys shall be used.
5. Dirt, grease, forming or machining lubricants, and organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing. Additional operations to remove the oxide coating just prior to welding shall be performed when the inert gas tungsten arc welding method is used. This may be done by etching or by scratch brushing. The oxide coating may not need to be removed if the welding is done with the automatic or semi-automatic inert gas shielded metal arc.
6. Suitable edge preparation to assure 100 percent penetration in butt welds shall be used. Oxygen cutting shall not be used. Sawing, chipping, machining, or shearing may be used.

7. Welding of aluminum shall be done using a nonconsumable tungsten electrode with filler metal in an inert gas atmosphere (TIG) or using a consumable filler metal electrode in an inert gas atmosphere (MIG). No welding process that requires the use of a welding flux shall be used.

C. Welding Stainless Steel

- a. The general requirements of AWS D1.1, Structural Welding Code - Steel, shall apply to the welding of stainless steel. Welding of stainless steel shall be done with electrodes and techniques recommended in "Welded Austenitic Chromium - Nickel Stainless Steel - Techniques and Properties" distributed by the Nickel Development Institute, Toronto, Canada, and in accordance with AWS D10.4 Recommended Practice for Welding Austenitic Chromium - Nickel Stainless Steel Piping and Tubing.

D. Welding Steel

1. Welding of steel shall conform to AWS D1.1 "Structural Welding Code - Steel."
2. Welding of ASTM A 36 structural steel, ASTM A 500 and A 501 structural tubing, and ASTM A 53 pipe shall be with electrodes conforming to AWS A5.1 "Specification for Carbon Steel Covered Arc Welding Electrodes," using E70XX electrodes; AWS A5.17 "Specifications for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding," using F7X-EXXX electrodes; or AWS A5.20 "Specifications for Carbon Steel Electrodes for Flux Cored Arc Welding," using E7XT-X electrodes.

3.03 STRUCTURAL METALS

A. General

1. Structural or foundry items shall be carefully fabricated to true dimensions without warp or twist. Welded closures shall be neatly made; and where weld material interferes with
2. fit or is unsightly in appearance, it shall be ground off smooth.
3. Structural items shall be installed accurately and securely, true to level, plumb, in correct alignment and grade, with all parts bearing or fitting the structure or equipment for which intended. Cocking out of alignment, redrilling, reshaping, or forcing to fit fabricated items will not be permitted. Contractor shall place anchor bolts or other anchoring devices accurately and shall make surfaces which bear against structural items smooth and true to level to preclude the necessity of springing, redrilling, or reshaping.
4. Structural items needing a special alignment to preserve straight, level, even, smooth lines shall be rigidly supported and braced and kept braced until concrete, grout, or dry pack mortar has hardened for a period of not less than 48 hours.
5. The Contractor shall submit certified copies of mill tests or reports from a recognized commercial laboratory and they shall include chemical and tensile properties of each shipment of structural metal or part thereof having common properties. Tests and analyses shall be made in accordance with the applicable ASTM Standards.

B. Structural Aluminum

1. The Contractor shall furnish and install structural aluminum items as indicated on the Drawings and as specified. He shall provide supplementary parts necessary to complete each item even though such work is not definitely indicated on the Drawings and specified in the Specifications. Their size, form, attachment, and location shall be such as to conform to the best of current practice.
2. Materials not otherwise specified shall conform to the applicable ASTM Standards.

3. Hole centers may be center punched and cutoff lines may be punched or scribed. Center punching and scribing shall not be used where such marks would remain on fabricated material.
4. A temperature correction shall be applied where necessary in the layout of critical dimensions. The coefficient of expansion shall be considered to be 0.000013 per degree F.
5. Material 1/2 inch thick or less may be sheared, sawed, or cut with a router. Material more than 1/2 inch thick shall be sawed or routed. Cut edges shall be true and smooth, and free from excessive burrs or ragged breaks. Reentrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting. Flame cutting of aluminum alloys is not permitted.
6. Rivet or bolt holes may be punched or drilled to finished size before assembly. The finished diameter of holes for bolts shall be not more than 1/16 inch larger than the nominal bolt diameter. Holes shall be cylindrical and perpendicular to the principal surface. Holes shall not be drifted in such a manner as to distort the metal.
7. Structural material shall not be heated, with the following exceptions:
8. Aluminum material may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 30 minutes to facilitate bending or welding. Such heating shall be done only when proper temperature controls and supervision are provided to ensure that the limitations on temperature and time are observed.
9. Chips lodged between contacting surfaces shall be removed before assembly.

C. Structural Steel

1. Structural steel shall be delivered free from mill scale, rust, or pitting. Items not galvanized or protected by a shop coat of paint shall be protected from the weather until erection and painting. Contractor shall provide supplementary parts required for a complete structural steel erection even where such supplementary parts and work are not specified in detail in the Specifications or indicated on the Drawings.

3.04 ARCHITECTURAL AND MISCELLANEOUS SHEET METAL

- A. Surfaces to which sheet metal is to be applied shall be even, smooth, sound, thoroughly clean and dry, and free from defects that might affect the application. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed in accordance with these Specifications. Accessories or other items essential to the completeness of this sheet metal installation, though not specifically indicated on the Drawings or specified, shall also be provided. Nails, screws, and bolts shall be of the types best suited for the intended purpose and shall be of a composition that will not support galvanic action in the installation. Sheet metal which abuts into adjacent material shall be installed as indicated on the Drawings. Where not indicated on the Drawings, the installation shall be executed in the best manner meeting the standards of the trade.

PART 4 – PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 05010

SECTION 05500

MISCELLANEOUS METALWORK

PART 1 – GENERAL REQUIREMENTS

1.01 THE REQUIREMENT:

- A. The Contractor shall furnish, fabricate and install miscellaneous metalwork and appurtenances, complete and in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. 05010 Structural and Miscellaneous Metals

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS:

- A. All work specified herein shall conform to or exceed the requirements of the Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section.
- B. Products and their delivery, handling and installation shall be in accordance with the following trade standards, codes or specifications.
- C. Commercial Standards:

Aluminum Assn.	AA-M32	C22A41
AISC	Specifications and Commentary	
AISI	Specifications and Commentary	
ASTM A 36/A36M	Specification for Structural Steel	
ASTM A 48	Specification for Gray Iron Castings	
ASTM A 53	Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated, Welded and Seamless	
ASTM A 123	Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip	
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware	
ASTM A 307	Specification for Carbon Steel Externally Threaded Standard Fasteners	
ASTM A 563	Specification for Carbon and Alloy Steel Nuts	
ASTM A 575	Specifications for Steel Bars, Carbon, Merchant Quality, M-Grades	
ANSI/AWS D1.1	Structural Welding Code - Steel	
NFPA 101	Life Safety Code	

1.04 CONTRACTOR SUBMITTALS:

- A. Shop_Drawings: Shop drawings of all miscellaneous metalwork shall be submitted to the Engineer for review in accordance with Section 01300 entitled, "Contractor Submittals".
- B. Welders_Qualifications: Welders shall submit certified qualifications for the type of welding being performed.

PART 2 - PRODUCTS**2.01 GENERAL REQUIREMENTS:**

- A. Standard: All structural steel shapes, plates, bars and their products shall conform to the requirements of ASTM A 36.
- B. Corrosion_Protection: Unless otherwise shown, miscellaneous metalwork of fabricated steel, which will be used in a corrosive environment and/or will be submerged in water/wastewater shall be coated in accordance with Section 09900 entitled, "Paintings and Coating", and shall not be galvanized prior to coating. All other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication as specified herein.
- C. Stainless_Steel: Stainless steel metalwork shall be of Type 316 stainless steel.

2.02 STEEL PIPE HANDRAILS:

- A. Steel pipe handrails which may be partially or wholly submerged or which are located inside a hydraulic structure shall be entirely of Type 316 stainless steel. All other steel pipe handrails shall be standard 2 inch or 1-1/2 inch black steel pipe as shown on the plans made up by welding and hot-dip galvanized after fabrication.

2.03 STEEL STAIRS AND ALUMINUM SAFETY TREADS:

- A. Steel_Stairs: Steel stairs shall be fabricated in accordance with standard practice of the National Association of Ornamental Metal Manufacturers, and as shown. Steel stairs shall be hot-dip galvanized after fabrication.
- B. Safety_Treads: Safety stair treads shall be provided on all stairs and elsewhere where shown. The safety treads shall be 4-inches wide, shall be of aluminum and shall be American Metals Company, Style A; American Mason Safety Tread Company; or equal.

2.04 LADDERS:

- A. Ladders which may be partially or wholly submerged or which are located inside a hydraulic structure shall be entirely of Type 316 stainless steel. All other ladders shall be of carbon steel, hot-dip galvanized after fabrication.

2.05 METAL GRATING AND FLOOR HATCHES:

- A. General: Metal grating and floor hatches shall be of the design, sizes and types shown. Aluminum in contact with other metal or concrete shall have the contact surface shop-painted per System 10 specified under Section 09900 entitled, "Paintings and Coatings".
- B. Metal_Grating: Metal grating shall be of aluminum or stainless steel as shown. No single piece of grating shall weigh more than 80-lbs. unless specifically detailed otherwise. Aluminum shall be 6061T6 Alloy Bearing Bars and 6063T5 Alloy Cross Bars. Stainless steel shall be Type 316. All grating shall be completely banded. Grating shall be rated at 150 lb/sq. ft.
- C. Floor_Hatches: Floor hatches shall be of steel or aluminum as shown. Hatches shall be double-swing and shall be furnished with two (2) stay bars designed to hold the cover in an open position and provide a railing around the opening. The hatch shall be designed to provide storage for the stay bars when the hatch is closed. The hatch shall have four (4) flush handles and a gutter or moat-type edge drain complete with drain connection. Steel hatches shall be hot-dip galvanized after fabrication.

2.06 SEAT ANGLES AND SUPPORTS:

- A. Seat angles for grating shall be aluminum or stainless steel. All support angles buried, submerged or below top of hydraulic structures shall be stainless steel.

2.07 BOLTS AND ANCHORS:

- A. Galvanized_Bolts: Except where otherwise shown or specified, all bolts, anchor bolts and nuts shall be steel, galvanized after fabrication as specified herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing.
- B. Steel_for_Bolts: Except as otherwise specified herein, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A 307 Grade B, or threaded parts of ASTM A 36 and shall meet the following additional requirements:
 - 1. The nut material shall be free-cutting steel.
 - 2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.
 - 3. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.
- C. Stainless_Steel_Bolts: Unless otherwise shown, all bolts, anchor bolts, washers and nuts which are buried, submerged or below the top of the wall inside any hydraulic structure shall be of Type 316 stainless steel.
- D. Unless otherwise shown, expanding-type anchors shall be steel expansion type Hilti "Kwick-Bolt"; or equal. Lead caulking anchors will not be permitted. Size shall be as shown. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded buried, submerged or below top of hydraulic structure anchors shall be entirely stainless steel.

2.12 POWER-DRIVEN PINS:

- A. Power-driven pins shall not be used unless specifically approved by the Engineer.

PART 3 - EXECUTION

3.01 FABRICATION AND INSTALLATION REQUIREMENTS:

- A. Fabrication and Erection: Except as otherwise shown, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction".
- B. Steel Railings: Field welding of steel pipe handrail joints will be permitted only if approved by the Engineer.

3.02 WELDING:

- A. Method: All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.
- B. Quality: In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified for the AWS Code. Upon completion of welding, all weld splatter, flux, slag and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. All burrs, spatter and sharp corners of material shall be ground smooth prior to coating.

3.03 GALVANIZING:

- A. All structural steel plates, shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153. Field repairs to galvanizing shall be made using "Galvinox", "Galvo-Weld", or approved equal.

END OF SECTION 05500

SECTION 15010

PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of piping.

1.02 SUBMITTALS

Shop drawings and operation and maintenance (O & M) Manuals shall be submitted in accordance with Section 01300 of these specifications. Piping shall be installed as indicated on the plans. Contractor shall submit to the Owner, for review and approval, his detailed proposed layouts prior to any fabrication or manufacturing. Contractor shall submit detailed shop drawings indicating horizontal and vertical locations of all piping including all piping on walls and ceilings.

PART 2 - MATERIALS

2.01. GENERAL

- A. Any pipe which does not meet specifications or has been rejected shall be removed from the jobsite and disposed of by the Contractor at no extra cost to the Owner.
- B. Lines under low head shall be laid flat or with a continuous grade so that there will be no air traps or humps in them, except at the ends where means for venting shall be provided.

2.02. EXPOSED PIPING

- A. Where not detailed, exposed pipe shall be installed in straight runs parallel to the axes of the structures. Pipe runs shall be horizontal and vertical except that gravity drain lines shall be pitched down in the direction of flow not less than 1/8 inch per foot.
- B. No exposed piping shall be erected until all equipment to which the pipe is to be attached has been installed and it can be determined where piping and fittings shall be located to make a neat efficient arrangement.
- C. The Plans shall be taken as diagrammatic for piping that is not shown in detail. Sizes of piping and their locations are indicated, but it is not intended to show every offset and fitting nor every structural difficulty that will be encountered during the installation of the work.
- D. Piping shall be installed so that they shall not impair the strength of construction Contractor shall submit Shop Drawings indicating horizontal and vertical location of all piping including all exposed piping on each wall and for ceiling.
- E. The alignment of pipes may be varied from that indicated on the Plans, without extra expense to the Owner where necessary to avoid structural or mechanical difficulties or to avoid the work of any other trades. The Contractor shall furnish such parts and pieces as may be necessary to provide a complete and operable system.
- F. Pipework shall be suspended and supported as shown on the Drawings and in such manner as to prevent sagging or overstressing of pipe and connections and, furthermore, shall be supported so that no item of the piping system will transfer any load or stress to any equipment.
- G. Air bleeder cocks shall be installed at all high points in pipe systems and pump cases and shall be of

the size indicated on the Plans or minimum of 1 inch. Air bleeder cocks shall be 1- or 2-inch stainless steel ball valves.

- H. Piping shall be made up with a sufficient number of true unions or flanged joints to permit ready separation of lines as necessary for inspection and maintenance, as determined by the Owner, in addition to such joints as are definitely shown on the Plans.
- I. Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Flanges, true unions, flexible couplings, and other connections shall come together at the proper orientation. The fit shall not be made by springing any piping nor shall orientation alignment be corrected by taking up on any flange bolts. Flange bolts, union halves, flexible connectors, etc. shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to fit at no additional cost to the Owner.

2.03. WALL AND SLAB PENETRATION

- A. No pipe shall pass through or be built into any reinforced masonry or concrete wall, floor, ceiling, roof, pilaster, column, pier, or beam, unless it is inside of a sleeve. Exceptions will be indicated on the Plans with a specific note, or specified in the Specifications, and unless so stated in words, no exception shall be considered as having been allowed in the Contract Documents. Such sleeves shall have an inside diameter not less than the outside diameter of the pipe plus 1 inch, except that for pipe smaller than 1 inch, the ID of the sleeve shall be not less than twice the OD of the pipe. Such sleeves shall be placed not closer than three diameters. The arrangement of sleeves shall be such that pipe can be pulled out of a sleeve and replaced without disturbing the structural member. Ends of sleeves shall be flush with surfaces of concrete, masonry, or plaster.
- B. Where pipes pass through floors, walls, or ceilings of finished spaces, the end of the pipe sleeve shall be concealed with an appropriate escutcheon. Escutcheon plates shall be chrome-plated steel plates, Dearborn Brass District, No. 5358 or No. 5340H; Keeney Manufacturing District, No. 102 or 105; Beaton and Corbin No. 1 or 13; or equal. The space between the pipes and sleeves shall be sealed as indicated on the Plans.

2.04. PIPING SCHEDULE

- A. Where not specifically noted on the Plans or otherwise specified, pipe shall be installed in accord with the following schedule.
- B. Pipe listed as "aboveground" shall include that within buildings or other structures without regard to its elevation. "Underground" piping shall be taken to mean only that piping actually buried in the soil or cast in concrete masonry.
- C. The Contractor may, at his expense, furnish piping of the same material as shown in the PIPING SCHEDULE but of greater pressure rating than that specified.
- D. Where bell and spigot joints are shown on the Plans or specified, mechanical joints or push-on joints may be used.
- E. The Contractor is responsible for furnishing and installing all necessary piping to make all equipment and other parts of the facility functional.

2.05. DUCTILE IRON PIPE AND FITTINGS

A. General

1. Ductile iron pipe shall conform to the requirements of ANSI A 21.50 and ANSI A 21.51 (AWWA C 150 and AWWA C 151). Minimum wall thickness shall be that corresponding to pressure Class 52.
2. For shipment, piping material shall be blocked in such manner as to prevent damage to castings or lining. Piping material shall be carefully handled during loading, unloading, and installation.
 - i. Piping material shall not be dropped from cars or trucks to the ground but shall be carefully lowered by mechanical means.
 - ii. Pipe shall not be dropped nor pounded to fit grade.
3. Damaged lining shall be repaired to match the quality, thickness, and bonding of the original lining.
4. Where it is impossible to repair damaged lining or where the repair is not satisfactory, the piping shall be removed and new piping with sound lining shall be installed in place of the removed piping.

B. Mechanical Joints

1. Mechanical joints shall be in accordance with AWWA C 111/ANSI A21.11.

C. Restrained Mechanical Joints

1. Design

- i. Restrained joints shall be designed with a safety factor of 2:1 at the line test pressure.
- ii. Products
 - a. Joints shall be as manufactured by U.S. Pipe, or Engineer approved equal.
 - b. Restrained mechanical joints shall incorporate follower gland which includes a restraining mechanism.
 - (i) The restraining mechanism shall grip the pipe and shall increase its resistance as pressure is increased.
 - (ii) The gland shall be ductile iron in accordance with ASTM A 536.
 - (iii) Restraining devices shall be ductile iron heat treated to 370 BHN.
 - (iv) Twist off nuts shall be used to ensure actuating of the restraining device.
 - (v) Acceptable joint shall be EBAA Iron, Inc., MEGALUG; or Engineer approved equal.
 - (vi) Systems using set screws as locking devices will not be acceptable.

D. Fittings

1. Except as otherwise provided, fittings for ductile iron pipe shall be as specified in ANSI A 21.10 (AWWA C110) or ANSI A21.53 (AWWA C153), of the same pressure rating and same joint configuration as the pipe with which they are used.

E. Flexible Couplings

1. Flexible couplings applicable to ductile iron pipe shall be as specified in Section 15162.

F. Lining and Coating

1. Except as otherwise specified, all ductile iron pipe and fittings shall be cement mortar lined in accordance with ANSI A 21.4 (AWWA C 104). Special attention shall be given to the lining of fittings. Lining shall be applied to clean bare metal. All lining shall extend to the faces of flanges, to the end of spigots, or to the shoulder of hubs, as the case may be.
2. In addition, all ductile iron pipe and fittings shall be coated inside and outside with bituminous material except that pipe which is to be painted shall not be coated on the outside.
3. Pipe with bituminous lining shall not be used for any potable water piping.

2.06. STEEL PIPE

A. General - Specified or indicated on the Drawings, steel pipe and fittings shall be as follows:

1. Steel pipe shall be seamless or straight seam electric resistance welded pipe conforming to the requirements of ASTM A53, A134, A135, or A139. Steel pipe shall conform to AWWA C200. Steel pipe shall be standard weight wall thickness.
2. All pipes shall be black unless indicated otherwise on the Drawings or specified to be galvanized. If galvanized, it shall be galvanized in accord with ASTM A 153. The working stress for any of the steels specified as acceptable for fabrication of pipe shall not exceed 50 percent of the yield point of the steel used.

B. Joints

1. Steel pipe joints shall be screwed, welded, flanged, or flexible joints as is appropriate to the pipe size and application, except that galvanized pipe shall not be welded. Welding shall be in accord with AWWA C 206.
2. Piping shall be made up with a sufficient number of unions, flexible couplings, or flanged joints to permit ready separating of lines for maintenance in addition to any unions or flanges indicated on the Plans. The Owner may direct the location of any unions, flexible couplings, or flanged joints, in addition to those indicated on the Plans, at their discretion.
3. Unless otherwise specified or indicated on the Plans, pipe joints shall be of the type specified below. Pipe smaller than 2 inches may have screwed joints. Pipe $\frac{3}{4}$ inches through 2 inches shall have threaded or flexible couplings. Pipe larger than 4 inches shall have flanged or welded joints or flexible couplings as shown on the plans.
4. Threading shall be done with clean, sharp dies. Pipe threads carelessly made, wavy, rough, or chewed shall be rejected. All screwed joints shall be tightly and neatly made up with an application of Teflon tape, applied to the male threads only.

5. Flanges shall come together at the proper orientation with no air gaps between the flanges after the gaskets are in place. The fit shall not be made by springing any piping, nor shall the orientation alignment be corrected by taking up on any flange bolts. Flange bolts shall slip freely into place with absolutely no binding. If the proper fit is not obtained, the piping shall be altered at no additional cost to the Owner. Machined flanges or tapered fillers shall be used to accomplish changes in grade or to slope lines for drainage.
6. All welded joints shall be electric welded. Welding shall be in accord with AWWA C 206. Qualification of welders shall be as covered in AWWA C 206. All testing of welders shall be at the Contractor's expense, including cost of test nipples, welding rod, and equipment.

C. Fittings

1. Fittings used with screwed pipe shall be 150 pounds malleable iron banded screwed fittings in accord with ANSI B 16.3.
2. Flanged fittings shall be 150 pounds or 300 pounds steel flanged fittings in accord with ANSI B 16.5. All flanges shall be flat-faced unless shown otherwise.
3. Companion flanges shall be 150-pound or 300 pound welding neck steel flanges in accord with ANSI B 16.5.
4. Welding neck flanges shall be secured by full penetration butt welds without backing rings. After welding in place, the faces of flanges shall be perpendicular to the axis of the pipe, or, in the case of fittings, at the proper angle to each other, and bolt holes shall be in proper alignment. Flanges shall be shop welded to pipe or fittings before lining is applied.
5. Machined flanges or tapered fillers shall be used to accomplish changes in grade, or to slope lines for drainage.
6. Flange bolts shall be in accordance with ANSI B 16.5, and flanges shall have Type 316 stainless steel bolts, nuts, and washers.
7. All flange bolts shall be cut and finished to project not more than 1/4 inch beyond outside face of nut after joint is assembled. Where cap screws or stud bolts are required, flanges shall be provided with tapped holes for such cap screws or stud bolts.
8. Welding fittings shall be factory made wrought steel butt-welding fittings in accord with ANSI B 16.9. Wall thickness shall not be less than the adjacent piping. Weld-o-lets and thread-o-lets shall be stainless steel (300 Series).

D. Cement Mortar Lining

1. Steel pipe specified or shown on the Plans to be cement mortar lined shall be shop lined in accord with AWWA C 205, or lined after installation by means of a pipe lining machine. Lining shall be 1/2-inch minimum thickness. If a lining machine is used, it must be approved by the Owner and be capable of applying a lining comparable in density and smoothness and of the same thickness as the above specified shop applied lining. In-place lining shall conform to applicable portions of AWWA C 602.

E. Coating

1. Above ground steel pipe shall be cement mortar lined per AWWA C205 and painted as provided in Section 09900 of these Specifications. Below ground steel pipe shall be cement mortar lined and coated per AWWA C205.

2.07. PIPE HANGERS AND SUPPORTS

A. General

1. The Plans do not, in all cases, show where or how pipe is supported; however, it is intended that all pipe and fittings shall be properly supported, suspended, or anchored as required to prevent sagging, overstressing, or longitudinal movement of certain piping, and to prevent thrusts or loads on or against pumps, meters, and other equipment. The pipe support manufacturers shall determine the proper support size where sizes have not been indicated on the Plans.
2. In addition to supports indicated on the Plans, exposed piping shall be supported at the base of all risers, at intervals not to exceed 4 feet on all horizontal runs of pipe 2 inches and smaller, and at intervals not to exceed 10 feet on all horizontal runs of pipe larger than 2 inches. Piping 4 inches and larger through fill, backfill, or disturbed ground shall be supported at intervals not to exceed 10 feet with supports as detailed on the Plans. Plastic pipe and tubing, copper pipe and tubing, and rubber hose and tubing shall be supported at close enough intervals to prevent noticeable sagging (in no case more than 2.5 feet for diameters of less than 1-1/2 inches and 4 feet for diameters of 1-1/2 inches and larger), or shall be carried in trays.
3. Plastic pipe, valves, and headers shall be securely anchored to prevent any apparent movement during operation of valves. Plastic pipe shall be anchored between expansion loops and/or direction changes to provide for uniform expansion.
4. Where concrete supports are used under piping, the supports shall be poured 1 inch low, then the next day or later, the pipe grouted in place with nonshrink grout. Nonshrink grout shall be used under floor flanges to give level bearing. Floor flanges shall be bolted to the floor with at least two bolts, or as shown on the Plans.
5. Hanger rods shall be sized in accordance with the manufacturer's recommendation, or as shown on the Plans.
6. Special details are shown on the Plans for special supports for heavy pipe and specials. Such supports shall be of heavy or sturdy design to carry the loads imposed thereon.
7. No use shall be made of chains, plumbers' straps, wire, or other such devices for suspending, supporting, or clamping pipe of any size or type.
8. Brackets, supports, hangers, etc. shall be painted as specified in Section 09900.
9. Except as otherwise specified or approved, hangers and supports shall be as follows.

B. Single Pipe Hangers and Supports

1. Single pipe hangers for pipe over 6-inch shall be adjustable clevis hangers, Stainless steel Bergen-Patterson Part 100; Grinnell Figure 260; or equal.
2. Single pipe hangers for pipes 6-inch and smaller may be stainless steel as specified above or may be, Bergen-Patterson Part 233 or 240; Grinnell Figure 104 or 101; or equal.

C. Wall or Ceiling Clamps

1. Pipe fastened against walls or ceiling shall be spaced out from the surface to allow the makeup of unions, fittings, etc. For pipe larger than 2-inch, supports shall be offset pipe clamps, Elcen Figure 44; Bergen-Patterson Part 179; or equal. For pipe 2-inch and smaller, supports shall be as above.

D. Trapeze Hangers

1. Use shall be made of trapeze hangers where shown on the Plans or where several pipes are located at the same elevation in a horizontal plane. Unistrut sections, fittings, etc., or their equal, shall be as called for on the Plans.

2.08. Wall Brackets

1. Wall brackets shall be fabricated steel, Bergen-Patterson Part 84; Grinnell Figure 195; or equal.

2.09. TRAY SYSTEM Not used

PART 3 - EXECUTION

3.01. GENERAL

- A. Equipment shall be painted in accordance with the requirements of Section 09900. Installation and testing shall be performed in accordance with Section 15042 of the Specifications.

3.02. CONNECTIONS OF DISSIMILAR METALS

- A. Connections between dissimilar metal piping, tubing, and fittings shall be made with dielectric couplings especially designed for this purpose and service.

3.03. CLEANING AND TESTING

- A. The interior of all pipelines, above or below grade, shall be thoroughly cleaned of all adhering matter and other debris to the approval of the Owner. No testing of any pipeline shall be started until the cleaning is complete and approved by the Owner.
- B. Special precautions required in the cleaning of a particular pipeline shall be as stated in the various parts of this Division of these Specifications.
- C. All pipelines, above or below grade, shall be tested to the pressures indicated in the various parts of this Division of these Specifications. Any piping for which test pressure is not specified shall be tested under a pressure of 50 psi above the operating head or as directed by the Owner.
- D. Pipe underground may be tested before backfilling unless otherwise specified, and pipes to be encased in concrete or under concrete slabs shall be tested before the encasement or slabs are poured.
- E. The Contractor shall furnish all necessary personnel, supplies, equipment, bulkheads, and whatever additional equipment is required to make any and all tests specified and shall make any and all repairs, including relaying if necessary, to any and all pipelines failing to pass the testing requirements of these Specifications.
- F. The Contractor shall give the Engineer a list of the scheduled pipeline tests two working days preceding the scheduled test or tests. The Contractor shall notify the Engineer by written memorandum of his readiness (not just his intention) to test a line or portion of line. All bulkheads, thrust blocks, anchors, temporary connections, pumps, etc. shall be in place before the Contractor's notification of readiness is given to the Engineer. After testing, all pipes shall be flushed or blown out and left clean.
- G. In testing with water, the test pressure specified shall be the pressure at the lowest point in the piping concerned or at least 150 psi. In testing with water, the lines shall be examined and any visible leaks

repaired. In testing with air, the lines shall be examined and tested with soap suds and any leaks repaired. Testing shall be repeated until the lines are approved by the Engineer.

- H. Despite any previous testing, any leaks developing before the end of the one year guarantee period shall be repaired by the Contractor at no additional expense to the Engineer.
- I. All liquid piping shall be tested with water at the pressure specified under PIPING SCHEDULE.

3.04. DUCTILE IRON PIPE

- A. Installation of ductile iron piping shall be in accordance with AWWA C600.
- B. Pipe and fittings shall be carefully handled during loading, unloading, and installation. No pipe shall be dropped from cars or trucks to the ground. All pipe shall be carefully lowered to the ground by mechanical means. In shipping, pipe and fittings shall be blocked in such manner as to prevent damage to castings or cement lining. Any broken or chipped lining shall be carefully patched to the satisfaction of the Engineer. Where it is impossible to repair broken or damaged lining in pipe because of its size, the pipe shall be rejected as unfit for use unless facilities are provided for relining pipe in accordance with these Specifications. Pipe shall not be dropped or pounded to fit grade.
- C. All mechanical joint or bell and spigot pipe shall be laid with 1/8-inch space between the spigot and shoulder of the pocket.

PART 4 - PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15010

SECTION 15041

CHLORINATION OF WATER MAINS FOR DISINFECTION

PART 1 – GENERAL

- 1.01. Description** – This section describes the disinfection of potable water mains, services, appurtenances, and connections by chlorination, in accordance with ANSI/AWWA B300, B301, C651 and C652 and as specified herein.
- 1.02. Related Work Specified Elsewhere**
- A. Hydrostatic Testing of Pressure Pipelines: 15042.
- 1.03. Job Conditions**
- A. Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Contractor shall procure an NPDES permit prior to beginning of work.
 - B. The rate of flow and locations of discharges shall be scheduled in advance to permit review and coordination with Owner and jurisdictional regulatory authorities.
 - C. Potable water shall be used for chlorination.
 - D. Requests for use of water from Owner waterlines shall be submitted 48 hours in advance.
 - E. Chlorination shall be performed prior to hydrostatic testing for pipelines having a diameter of 12-inches and larger. See Part 3, Paragraph A-9 for concurrent testing of smaller diameter pipelines.

PART 2 - MATERIALS

2.01. Liquid Chlorine Solution

- A. Liquid chlorine solution shall be in accordance with the requirements of ANSI/AWWA B301, and shall be injected with a solution feed chlorinator and a water booster pump or a sufficiently pressurized source of water to provide an adequate flow to inject and disperse the chlorine solution.

2.02. Calcium Hypochlorite (Granules)

- A. Calcium Hypochlorite shall not be used.

2.03. Sodium Hypochlorite (Solution)

- A. Sodium Hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300, and shall be diluted in water to desired concentration and pumped into the pipeline at a measured rate.

2.04. Calcium Hypochlorite Tablets and Adhesive

- A. See San Antonio Water Company Specification Special Provisions Section IX 9.02. previously included for use of Tablet disinfection.

2.05. Chlorine Residual Test Kit

- A. For measuring chlorine concentration, a medium range, drop count, titration kit or an orthotolidine indicator comparator with wide range color discs shall be used. The kit shall be capable of determining chlorine concentration in the range 1.0 to 25 mg/L. Test kits shall be Hach Chemical, Hellige, or for contracts between Owner and Contractor, approved equal. An adequate number of kits shall be maintained by the Contractor in good working order and available for immediate test of residuals at points of sampling.

PART 3 – EXECUTION

3.01. PIPELINES

- A. General: Before being placed into service, all pipelines and appurtenances shall be chlorinated. Pipelines with a diameter of 10-inches or less shall be disinfected by direct chlorine solution injection. Pipelines with a diameter of 12-inches and larger shall be disinfected by direct chlorine solution injection. Steel pipelines shall be disinfected by direct chlorine solution injection. Bacteriological testing after disinfection shall be performed by the Owner or Owner approved laboratory.
- B. Chlorination Contractor: Chlorination shall be performed by a certified chlorination and testing Contractor. Chlorination shall be in accordance with the instructions of the chlorinator manufacturer.
- C. Groundwater: In the event groundwater is encountered and it is impossible to prevent its entrance into the mains, or the mains are not free from dirt, they shall be thoroughly flushed prior to disinfection. Disinfection shall be by direct chlorine solution injection.
- D. Services: Every service connection served by a main being disinfected shall be tightly shutoff at the curb stop before water is applied to the main. Care shall be taken to expel all air from the main and services during the filling operation.
- E. Pipeline Flushing:
 - 1. Before chlorinating pipeline, flush pipes with water to remove dirt and debris. Maintain a flushing velocity of at least 3 feet per second. Flush pipes for a minimum of the time period calculated from the formula:
$$T = \frac{2}{3}L$$
in which:
T = flushing time in seconds
L = pipe length in feet
- F. Chlorine Solution Injection by the Continuous Feed Method:
 - 1. Chlorine solution shall be applied by means of a vacuum-operated chlorinator and a booster pump or a sufficiently pressurized source of water to provide an adequate flow to operate the eductor system and properly disperse the chlorine solution. Direct-feed chlorinators, which operate from gas pressure in the chlorine cylinder, without a vacuum regulator, shall not be used for application of a chlorine solution.
 - 2. Chlorine solution shall be applied at the beginning of the section to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected. All required corporation stops and other plumbing materials necessary for chlorination or flushing of the main shall be installed by the Contractor.
 - 3. Potable water shall be introduced into the pipeline at a constant measured rate.

Chlorine solution shall be injected into the potable feed water at a measured rate. The two rates shall be proportioned so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 50 mg/L to 100 mg/L, with a chlorine residual of 25 mg/L after 24 hours in the pipe. The concentration at points downstream shall be checked periodically during the filling to ascertain that sufficient chlorine is being added.

- G. Disinfection of Valves and Appurtenances: During the period that the chlorine solution or slug is in the section of pipeline, valves shall be opened and closed to obtain a chlorine residual at hydrants and other pipeline appurtenances. Care shall be taken to ensure that no chlorinated water enters any active pipeline.
- H. Concurrent Testing (for Pipelines with Diameter of 10-inches or Less): Disinfecting mains and appurtenances, and hydrostatic testing may run concurrently for the required 24-hour test period. In the event there is leakage and repairs are necessary, disinfection of the pipeline shall be repeated by injection of chlorine solution into the line as provided in this section.
- I. Confirmation of Residual: After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, samples shall be taken at air valves and other points of access to confirm that a chlorine residual of 25 mg/L minimum exists along the pipeline.

With the slug method, samples shall be taken as the slug passes each access point and as it leaves the pipeline in order to confirm that a chlorine residual of 25 mg/L minimum is present.

- J. Pipeline Flushing and Dechlorination: After confirming the chlorine residual, excess chlorine solution shall be flushed from the pipeline until the chlorine concentration in the water leaving the pipe is within 0.5 mg/L of the replacement water. Dechlorination chemicals or tablets shall be used to neutralize the excess chlorine solution prior to flushing into the storm drain. This may require a permit from the regulatory agency. Flushing into the sewer system is strictly prohibited.
- K. Bacteriologic Tests: Samples for bacteriologic testing shall be taken 24 hours after pipeline flushing is complete. The location and quantity of samples shall be determined by the Owner. The samples shall be delivered to an independent laboratory within six hours. A bacteriologic quality test will be performed by the laboratory, and test results shall be delivered to the Owner to demonstrate the absence of coliform organisms and a plate count of less than 500, in each separate section of the pipeline after chlorination and refilling.
- L. Repetition of Procedure: If the initial chlorination fails to produce required residuals and bacteriologic tests, chlorination and testing shall be repeated until satisfactory results are obtained.
- M. Test Facility Removal: After satisfactory disinfection, air valves shall be replaced, the pipe coating restored, and temporary disinfection and test facilities removed.

PART 4 – PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15041

SECTION 15042

HYDROSTATIC TESTING OF PRESSURE PIPELINES

PART 1 – GENERAL

1.01 Description

- A. This section describes pressure and leakage testing of all pressure pipelines, in accordance with ANSI/AWWA C600 and as specified herein.

1.02 Related Work Specified Elsewhere

- A. Chlorination of Water Mains for Disinfection: 15041.

1.03 Submittals

- A. Shop drawings shall be submitted in accordance with Section 01300 and the following.
- B. Test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses.

1.04 Job Conditions

- A. For potable water pipelines, obtain and use only potable water for hydrostatic testing. See Special Provision Section for availability of water.
- B. Submit request for use of Owner water to the Owner 48 hours in advance.
- C. Hydrostatic testing shall be successfully completed before new pipelines are connected to existing Owner pipes and mains.

1.05 Testing Company

- A. All testing shall be performed by an independent certified Owner-approved testing company or as called out in the project plans, specifications and contract documents. The testing company will be required to provide the Owner Representative with certified testing results. Testing company shall provide gauges and meters which have been calibrated and certified annually.

PART 2 – MATERIALS

2.01. Test Bulkheads

- A. Test bulkheads shall be designed and tested in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code. Bulkhead design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Stress shall be limited to 70% of yield strength of the bulkhead material at the bulkhead design pressure. Air- release and water drainage connections shall be included.

2.02. Manual Air-Release Valves

- A. Temporary manual air-release valves shall be provided as necessary for pipeline test. The pipe outlet shall be constructed in the same manner as for a permanent air valve and after use, sealed with a blind flange, pipe cap, or plug and coated equal to the adjacent pipe.

2.03. **Water**

- A. The same water used for chlorination of the pipeline may be used to fill the line for testing. Make up water for testing potable water pipelines shall be potable water.

PART 3 – EXECUTION

3.01. **General**

- A. All labor, materials, tools, and equipment for testing shall be furnished by the Contractor. The test shall be conducted with valves in the test section open. Ends of each test section, open ends of pipes, valves, and fittings shall be suitably closed. Valves in the test section shall be operated during the test period.

3.02. **Testing and Disinfection Sequence**

- A. See Section 15041, Chlorination for Disinfection of Water Mains.

3.03. **Isolation of Test Pipe Section from Existing Potable Water Pipelines**

- A. Test bulkheads, valves, connections to existing pipelines, and other appurtenances shall be located and installed in a manner to provide air gap separation between existing potable water pipelines and pipeline being tested.

3.04. **Length of Test Section**

- A. The maximum length of test section for pipe of 12-inches or smaller in diameter shall be 3,500 feet; for pipe larger than 12-inches, 1 mile. Test bulkheads shall be provided where the distance between valves exceeds these limits.

3.05. **Requirements Prior to Testing**

- A. Backfill: The pipe trench shall be backfilled with a minimum of 2 1/2 feet of material, or center loaded to hold the pipe in place while testing.
- B. Concrete Anchor and Thrust Blocks: All concrete anchor blocks shall be allowed to cure a sufficient time to develop the designed minimum strength before testing.
- C. Mortar Lining: Steel pipelines shall not be tested before the mortar lining and coating on all of the pipe lengths in the line have attained an age of 14 days. Cement-mortar lined pipe shall not be filled with water until a minimum period of eight hours has elapsed after the last joint in any section has been made.
- D. Flushing: All pipelines shall be blown out or flushed out using a flushing ball or pig.

3.06. **Field Test Procedure**

- A. Filling Rate: The pipeline shall be filled at a rate such that the average velocity of flow is no ~~greater~~ than 1 fps. At no time shall the maximum velocity of flow exceed 2 fps. The following table relates velocity filling rate to an equivalent volume flow rate for pipe diameters 10-inches and under.

Filling Rates in gpm
Equivalent to Filling Velocities of 1 fps, for Pipes Flowing Full

Nominal Size (inches)	Flow Rate Q (gpm)
4	9.8
6	14.7
8	19.6
10	24.5

- B. Air Removal: All air should be purged from the pipeline before checking for leaks or performing pressure tests on the system. To accomplish this, if air valves or hydrants or other outlets are not available at high points, taps shall be made to expel the air, and these taps shall be tightly plugged after testing.
- C. Pressurization: After the pipeline has been filled and allowed to sit a minimum of 48 hours (72 hours for mortar-lined pipelines), the pressure in the pipeline shall then be pumped up to the specified test pressure. If a large quantity of water is required to increase the pressure during testing, entrapped air, leakage at joints, or a broken pipe may be suspected. TESTS SHOULD BE DISCONTINUED until the source of trouble is identified and corrected.
- D. Field Test Pressure: Unless otherwise specified, the pipeline shall be subjected to a field hydrostatic pressure of 200 psi for Class 150 and Class 200 PVC pipe, and 125% of design pressure for steel pipe, but not to exceed 200 psi.

3.07. **Allowable Leakage**

A. Pipelines of Diameter 10-inches and Under:

1. When the test pressure has been reached, pumping shall be discontinued until the pressure in the line has dropped 5 psi, at which time the pressure shall again be pumped up to the specified test pressure. This procedure shall be repeated until four hours have elapsed from the time the specified test pressure was first applied. At the end of the four-hour period, the pressure shall be pumped up to the test pressure for the last time.
2. The leakage shall be considered as the total amount of water pumped into the pipeline during the four-hour period, including the amount required in reaching the test pressure for the final time. Leakage shall not exceed the rate of 24 gallons per inch of diameter per mile of pipe per 24 hours for Class 150 pipe, and 30 gallons per inch of diameter per mile of pipe per 24 hours for Class 200 pipe. The following table indicates the leakage allowance for various sizes of pipe for Class 150 and Class 200 pipe and is equal to the number of gallons per the four-hour test per 1,000 feet of pipe being testing:

LEAKAGE ALLOWANCE

Pipe Size (Inches)	Test Pressure (psi)		Allowable Leakage Gallons per four hours per 1,000 feet of pipe	
	Class 150	Class 200	Class 150	Class 200
4	200	200	1.5	1.7
6	200	200	2.3	2.6
8	200	200	3.0	3.4
10	200	200	3.8	4.3

1. One to three days shall be allowed for the filled pipeline to soak and to release entrapped air. The test pressure shall be applied with a positive displacement pump. A snubber and dampener shall be provided between the pump and the pipeline to reduce instantaneous pressure pulses to 10% of the specified test pressure. Water shall be drawn through a positive displacement meter.
2. Note the allowable leakage rate for pipeline sections with flanged, welded, and/or grooved-end joints shall be zero.

B. PVC Force Mains and Pipelines of Diameter 12-inches and Larger:

1. The test pressure shall be maintained for a four (4) hour duration by restoring it whenever it falls an amount of 5 psi.
2. The amount of water used to maintain the test pressure during the test period shall be considered the leakage. The allowable leakage shall be determined by the following formula:

$$L = \frac{ND(P)}{7400}^{1/2}$$

Where:

L is the allowable leakage in gallons per hour,
 N is the number of rubber-gasketed pipe joints in the test section
 D is the inside pipe test diameter in inches,
 P is the pipe test pressure (psig), which is defined as the average of the highest and lowest test pressures in the pipe section being tested.

3.08. **Repetition of Test**

- A. If the actual leakage exceeds the allowable, the faulty work shall be located and corrected and the test repeated. The work shall be restored, and all damage resulting from leaks repaired. All visible leakage shall be eliminated.

3.09. **Bulkhead and Test Facility Removal**

- A. After a satisfactory test, water shall be drained, test bulkheads and other test facilities removed, and pipe coatings restored.

PART 4 – PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15042

SECTION 15050

GENERAL PIPES AND FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Provisions Specification sections, apply to work of this section.

1.02 SUMMARY

- A. This section is generic in that it describes material and installation required by several other sections of this specification.
- B. Types of pipes and pipe fittings specified in this section include the following:
 - 1. Steel Piping
 - 2. Copper Piping
 - 3. Cast-Iron Pressure Piping
 - 4. Cast-Iron Soil Piping
 - 5. Grooved Joint Piping
 - 6. Miscellaneous Piping Materials/Products.
- C. Pipes and pipe fittings furnished as part of factory-fabricated equipment and are specified as part of equipment assembly in other Division-15 sections.

1.03 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications:
 - 1. Firm with at least three years history of successful experience on projects of similar nature.
 - 2. Licensed as a firm in the contractor state of origin and in the State of California.
 - 3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the contractor.
 - 4. All workmen employed on the project shall carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

1.04 WELDING CERTIFICATION:

- A. Each welder shall have passed a qualification test within the past six months.
- B. The test shall be in accordance with the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications", ASME Section VIII, and ANSI 313.
- C. The test report shall certify that the welder is qualified to weld the material to be used at the job site.
- D. The contractor shall submit three copies of each welder's qualification test report to the Project Manager for approval prior to commencing the work. No welder shall be used on the project until so certified.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.
- B. Welding Certifications: Submit reports as required for piping work.
- C. Brazing Certifications: Submit reports as required for piping work.
- D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division 1.

1.06 REFERENCES

- A. Codes and Standards:
 - 1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.
 - 2. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.
- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve, or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.02 STEEL PIPES AND PIPE FITTINGS

- A. Black Steel Pipe: Seamless or ERW, ASTM A 53.
- B. Galvanized Steel Pipe: ASTM A 53.
- C. Galvanized Seamless Steel Pipe: ASTM A 53.
- D. Electric-Resistance-Welded Steel Pipe: ASTM A 135.
- E. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.
- F. Cast-Iron Flanged Fittings: ANSI B16.1, including bolting.
- G. Cast-Iron Threaded Fittings: ANSI B16.4.
- H. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.
- I. Unions: ANSI B16.39; 300 lb. ground joint malleable iron, hexagonal, selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
- J. Dielectric Unions: 175 psig WSP at 250oF. Equal to Walter Vallet District V-line insulating coupling.
- K. Threaded Pipe Plugs: ANSI B16.14.
- L. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
 - 1. Material Group: Group 1.1.
 - 2. End Connections: Butt-welding.
 - 3. Facings: Raised-face.
 - 4. Steel Pipe Flanges for Waterworks Service: AWWA C207.
- M. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.
- N. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.
- O. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).

2.03 CAST-IRON SOIL PIPES AND PIPE FITTINGS

- A. Hubless Cast-Iron Soil Pipe: FS WW-P-401.
- B. Cast-Iron Hub-and-Spigot Soil Pipe: ASTM A 74.
- C. Hubless Cast-Iron Soil Pipe Fittings: Neoprene gasket complying with ASTM C 564 and stainless steel clamp holding band.
- D. Cast-Iron Hub-and-Spigot Soil Pipe Fittings: Match soil pipe units; complying with same standards (ASTM A 74).

- E. Compression Gaskets: ASTM C 564.
- F. Lead/Oakum Joint Materials: Provide products complying with governing regulations for use in service indicated.

2.04 ACID RESISTANT CAST IRON

- A. Bell and spigot type, high silicon iron alloy "Duriron", with chemical resistant packing and caulked lead joints.

2.05 GROOVED PIPING PRODUCTS: (ONLY WHERE ACCEPTABLE AND AS SHOWN ON PLANS)

- A. General: As Installer's option, mechanical grooved pipe couplings and fittings may be used for piping systems having operating conditions not exceeding 230oF (110oC), excluding steam piping and any other service not recommended by manufacturer, in lieu of welded, flanged, or threaded methods, and may also be used as unions, seismic joints, flexible connections, expansion joints, expansion compensators, or vibration reducers.
- B. Coupling Housings Description: Grooved mechanical type, which engages grooved or shouldered pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secure together during assembly with nuts and bolts. Permit degree of contraction and expansion as specified in manufacturer's latest published literature. (Victaulic style 77) For rigid joints (Victaulic "Zero Flex" style 07).
 - 1. Coupling Housings: Malleable iron conforming to ASTM A 47.
 - 2. Coupling Housings: Ductile iron conforming to ASTM A 536.
 - 3. Standard: Enamel coated, options hot dip galvanized.

2.06 GASKETS

- A. Mechanical grooved coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D 2000.
 - 1. Water Services: EPDM Grade E, with green color code identification.
 - 2. Other Services: As recommended by Manufacturer.

2.07 BOLTS AND NUTS

- A. Heat-treated carbon steel, ASTM A 183, minimum tensile 110,000 psi.
- B. Exposed Locations: Tamper resistant nuts.

2.08 BRANCH STUB-INS

Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts.

2.09 FITTINGS

- A. Grooved or shouldered end design to accept grooved mechanical couplings.

1. Malleable Iron: ASTM A 47.
2. Ductile Iron: ASTM A 536.
3. Fabricated Steel: ASTM A 53, Type F for 3/4" to 1-1/2"; Type E or S, Grade B for 2" to 20".
4. Steel: ASTM A 234.

2.10 FLANGES

- A. Conform to Class 125 cast iron and Class 150 steel bolt hole alignment.
 1. Malleable Iron: ASTM A 47.
 2. Ductile Iron: ASTM A 536.

2.11 SPECIALTIES

- A. Inline strainers.
- B. Suction diffusers.

2.12 GROOVES: CONFORM TO THE FOLLOWING

- A. Standard Steel: Square cut.
- B. Lightweight Steel: Roll grooved.
- C. Ductile Iron: Radius cut grooved, AWWA C606.

2.13 MANUFACTURER

- A. Subject to compliance with requirements, provide grooved piping products of one of the following:
 1. ITT Grinnell Corp.
 2. Stockham Valves & Fittings, Inc.
 3. Victaulic Co. of America.
 4. Gustin-Bacon
 5. Grippin.

2.14 MANUFACTURERS

- A. Manufacturer uniformity: conform with the requirements specified in Basic Mechanical Requirements, under "Product Options."
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering piping materials and specialties which may be incorporated in the work include, but are not limited to, the following:
 1. Pipe Escutcheons:
 - a. Chicago Specialty Mfg. Co.
 - b. Sanitary-Dash Mfg. Co.
 - c. Grinnell

2. Dielectric Waterway Fittings:
 - a. Epco Sales, Inc.
 - b. Victaulic District of America
3. Dielectric Unions:
 - a. Eclipse, Inc.
 - b. Perfection Corp.
 - c. Watts Regulator Co.
4. Strainers:
 - a. Armstrong Machine Works.
 - b. Hoffman Specialty ITT; Fluid Handling Div.
 - c. Spirax Sarco.
 - d. Victaulic Co. of America. (low pressure applications only)
 - e. Watts Regulator Co.
5. Expansion Joints:
 - a. Flexonics Div.; UOP, Inc.
 - b. Hyspan Precision Products, Inc.
 - c. Keflex, Inc.
 - d. Metraflex Co.
 - e. Vibration Mountings and Controls, Inc.
6. Flexible Connectors:
 - a. Flexonics Div.; UOP, Inc.
 - b. Hyspan Precision Products, Inc.
 - c. Keflex, Inc.
 - d. Metraflex Co.
 - e. Vibration Mountings and Controls, Inc.

2.15 PIPING SPECIALTIES

- A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.
- B. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.
- C. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.
- D. Dielectric Waterway Fittings: electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.
- E. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch.
 1. Provide strainers with 125 psi working pressure rating for low pressure applications, and 250 psi

pressure rating for high pressure application.

2. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
3. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
4. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
5. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EPDM gasket.

2.16 EXPANSION JOINTS

- A. Rubber Expansion Joints: Construct of duck and butyl rubber with full-faced integral flanges, internally reinforced with steel retaining rings. Provide steel retaining rings over entire surface of flanges, drilled to match flange bolt holes, and provide external control rods.
- B. Expansion Joints for Grooved Piping: Provide expansion joints constructed of cut grooved short pipe nipples and couplings, designed by manufacturer to suit intended service. Select couplings and gasket materials to match balance of piping system.

2.17 FLEXIBLE CONNECTIONS

- A. Braided Flexible Pump Connector: Stainless steel annular corrugated metal surrounded with a woven braid of high tensile stainless steel flange connection. Minimum 125 psi pressure rating, similar to Keflex KSSPC.
- B. Flexible Connector: Stainless steel annular, close pitch hose with stainless steel braid. Flanged or threaded connection, Minimum 125 psi pressure rating, similar to Keflex KFCS.

2.18 SLEEVES

- A. Sheet-Metal Sleeves: 10 gauge, galvanized sheet metal, round tube closed with welded longitudinal joint.
- B. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.

2.19 MECHANICAL SLEEVE SEALS

- A. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.20 MISCELLANEOUS PIPING MATERIAL/PRODUCTS

- A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

- B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements. Use no lead bearing solders in domestic water applications.

1. Tin-Antimony Solder: ASTM B 32, Grade 95TA.

2. Silver-Lead Solder: ASTM B 32, Grade 96TS.

- C. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.

Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

- D. Gaskets For Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.
- E. Piping Connectors For Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

MANUFACTURER: Subject to compliance with requirements, provide piping connectors of the following:

1. Fernco, Inc.
2. Mission.

- F. Dismantling Joint: AWWA Class D steel ring flange, compatible with ANSI Class 125 and 150 bolt circles. Pipe is STD weight class per ASTM A53. The end ring and body are made from ASTM A536 65-45 12 ductile iron.

1. Dismantling joint to be manufactured by Romac Model DJ400 only.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently- leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible union, flanges, etc., for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Do not cold spring. Store filler weld materials in accordance with codes.

Comply with ANSI B31 Code for Pressure Piping.

- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Provide high point vents, low point drains with valves and extension to drain for all piping.
- C. All piping in press room, mechanical rooms, fan rooms, etc., shall be exposed. Do not conceal or imbed piping in walls, floors or other structures.

- D. Make changes in direction or size with manufactured fittings. Anchor and support piping for free expansion and movement without damage to piping, equipment or to building.
- E. Piping shall be arranged to maintain head room and keep passageways clear.
- F. Provide unions at connections to equipment and elsewhere as required to facilitate maintenance.
- G. Run full pipe size through shutoff valves, gas cocks, balancing valves, etc. Change pipe size within three pipe size diameters of final connection to equipment, coils, etc.
- H. All piping shall be erected to insure proper draining. Air piping shall pitch down in the direction of flow a minimum of 1" per 40 feet. Domestic water and utility water shall slope down a minimum of 1" per 40 feet towards the drain (low point). Refrigerant suction line shall slope a minimum of 1" per 10 feet towards compressor. Soil, waste, vent, and roof drain lines shall slope in accordance with requirements of Uniform Plumbing Code.
- I. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.
- J. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal.
- K. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.
- L. Use fittings for all changes in direction and all branch connections.
- M. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.
- N. Install unions adjacent to each valve, and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.
- O. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.
- P. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air).
- Q. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water). Insulating fittings are not required between bronze valves and steel pipe or between copper coil headers and steel pipe.
- R. Electrical Equipment Spaces: Do not run piping in or through, electrical room, transformer vaults and other electrical or electronic equipment spaces and enclosures or above electrical gear unless authorized and directed. Install drip pan under piping that must be run through electrical spaces.

3.02 EXPANSION AND CONTRACTION

- A. Make all necessary provisions for expansion and contraction of piping.
- B. Use grooved joint couplings, expansion compensator, offsets or loops as required to prevent undue strain.
- C. At piping connection to heat exchangers provide expansion (joint) as shown on drawings.

3.03 FLEXIBLE CONNECTORS

- A. At pumps, engines and at all rotating or vibrating pieces of equipment, provide and install flexible connectors to accommodate alignment and vibration.
- B. At pumps provide and install a series of three grooved joint couplings or braided flexible pump connectors.
- C. At engines provide and install flexible connector.
- D. Install Owner furnished flex connectors for digester gas and natural gas.

3.04 PROTECTING COATINGS

- A. All underground steel pipes shall be wrapped with Scotchwrap No. 50 tape to give not less than two complete layers on the underground piping system, or piping shall have "X-tru Coat", factory applied plastic protective covering, or pipe shall be coated and wrapped with coal tar enamel and Kraft paper, all with coated and taped joints.

3.05 PIPING SYSTEM JOINTS

- A. General: Provide joints of type indicated in each piping system.
- B. Threaded: Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- C. Brazed: Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
- D. Soldered: Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- E. Welded:
 1. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.
 2. Weld pipe joints in accordance with recognized industry practice and as follows:
 3. Weld pipe joints only when ambient temperature is above 0oF (-18oC) where possible, with minimum pipe preheat to 50oF.
 4. Bevel pipe ends at a 37.5o angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
 5. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
 6. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
 7. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

8. At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.
 9. At Installer's option, install forged branch-connection fittings wherever branch pipe of size smaller than main pipe is indicated; or install regular "T" fitting.
- F. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
- G. Lead Joints: Tightly pack joint with joint packing material. Do not permit packing to enter bore of finished joint. Clean joint after packing. Fill remaining joint space with one pouring of lead to indicate minimum depth measured from face of bell. After lead has cooled, calk joint tightly by use of hammer and caulking iron.
- H. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions.
- I. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:
1. Heat Joining of Thermoplastic Pipe: ASTM D 2657.
 2. Making Solvent-Cemented Joints: ASTM D 2235, and ASTM F 402.
- J. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.06 CLEANING, FLUSHING, INSPECTING

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
1. Inspect pressure piping in accordance with procedures of ASME B31.
- B. Disinfect water mains and water service piping in accordance with AWWA C601.

PART 4 – PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15050

SECTION 15051

INSTALLATION OF PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes the placement of welded steel pipelines and pipe bedding, pipeline closures, welding and welded connections, lining and coating at joints, and encasement.

1.02 SUBMITTALS

- A. Submit shop drawings in accordance with the Section 01300.
- B. Submit installation schedule.
- C. Submit weld procedure specifications, procedure qualification records, and welder qualification certificates.
- D. Submit affidavit of compliance with standards referenced herein. All tests of material referenced shall be executed prior to fabrication and installation. Submit certified results with affidavits of compliance.

PART 2 - MATERIALS

2.01 PIPE MATERIAL

Refer to Sections 15010 and 15050.

2.02 BOLTS AND NUTS FOR FLANGES

- A. Bolts and nuts for buried flanges shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8 for bolts, and ASTM A 194, Grade 8 for nuts. Bolts and nuts for above ground flanges and flanges in vaults shall be Type 316 stainless steel. Fit shall be Classes 2A and 2B per ANSI B1.1 when connecting to valves with body bolt holes.
- B. Bolts for flange insulation kits shall conform to ASTM A 193, Grade B7. Nuts shall conform to ASTM A 194, Grade 2H.
- C. Provide washers for each nut. Washers shall be of the same material as the nuts.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

Location and invert elevations, materials of construction, and dimensions of existing pipelines and concrete encasements shown on the drawings are approximate.

3.02 DELIVERY AND TEMPORARY STORAGE OF PIPE AT SITE

- A. Limit onsite pipe storage to a maximum of one week.
- B. For shop lined pipe keep plastic caps or plastic with steel straps placed over the ends of each pipe until immediately prior to installation. Add water to interior of pipe if plastic cap is temporarily removed and replaced or repaired.
- C. Do not remove the plastic caps placed over the ends until the pipe is ready to be placed in the trench. Plastic caps may be opened temporarily to spray water inside the pipe for moisture control.

3.03 HANDLING OF PIPE

- A. Lift steel pipes with two 16-inch-wide belt slings and spreader bar or as recommended by the pipe manufacturer. Do not use cable slings. Avoid damage to coating.
- B. Measure the outside diameter of bell and spigot to check that clearance between laying surfaces is within specified tolerance prior to joint assembly.
- C. Where internal bracing is required, place in pipes prior to joint assembly and maintain internal braces placed in pipes 24 inches and larger until authorized by the Owner to remove.

3.04 SANITATION OF PIPE INTERIOR

When pipe laying is not in progress, close the ends of the pipe by a vermin- and child-proof plug.

3.05 PLACEMENT OF PIPE IN TRENCH

- A. Control water in trench per Section 02223.
- B. Lay pipes uphill if the pipe slope exceeds $\pm 10\%$ or otherwise hold in place by methods approved by the Owner.
- C. Excavate below the subgrade as shown on the construction plans. If in rock, complete excavation to a uniform foundation free of protruding rocks. Complete stabilization of foundation, per Section 02223, then place and compact material specified for the bedding in Section 02223 to bring the trench bottom to grade.
- D. Place and compact the pipe base as specified in Section 02223.
- E. Cut a depression to accommodate the pipe bell and application of joint coating and spaces to permit removal of the pipe handling slings.
- F. Each section of pipe shall be laid in the order and position shown on the schedule. Lower the pipe onto the pipe base and install it to line and grade along its full length on firm bedding except at the bell and at the sling depressions. Tolerances on grade are 1/4 inch. The tolerance on line is 1 inch.
- G. When installing beveled pipe, do not deviate the pipe top mark by more than 1/2 inch from a vertical line passing through the pipe center.
- H. Do not use dogs, clips, lugs or other devices welded to the pipe to force it into position.

3.06 OPERATIONS INCIDENTAL TO JOINT COMPLETION

- A. Plan joint completion to accommodate temporary test bulkheads for hydrostatic testing.

3.07 FLANGED CONNECTIONS

- A. Inspect gasket seating surfaces, gasket, each stud or bolt, each nut, each washer, and the facing on which the nuts will rotate. Replace any damaged item.
- B. Lubricate nuts and bolts and flange-to-nut contact surfaces with oil or graphite prior to installation.
- C. Attach gasket with adhesive as recommended by gasket manufacturer.
- D. Assemble all bolts in flange, then tighten bolts in the sequence and to the torque as recommended by the manufacturer. Retighten bolts after 24 hours. Replace galled, cracked, or distorted bolts and

nuts. Do not reuse bolts or nuts.

- E. Coat buried flanges with Coating System No. 24 (Section 09900).
- F. Lubricant for stainless-steel bolts and nuts shall be TRX-Synlub by Ramco, Anti-Seize by Ramco, Husk-It Husky Lube O'Seal or equal.

3.08 FIELD WELDED JOINTS

- A. Provide single-welded lap joints, double-welded lap joints, butt-welded joints, and butt-strap joints where detailed on the drawings. The minimum overlap of the assembled bell-and-spigot sections of lap joints shall be as shown on the drawings. Steel pipe with wall thickness of less than 1/4" shall not be butt welded.
- B. Field welding shall be in accordance with AWWA C206 except as modified herein. Welder's qualifications shall be in accordance with Section IX, Part QW, of the ASME Boiler and Pressure Vessel Code. Any welder performing work shall have been qualified for the process involved within the past three years.
- C. Prior to welding interior joint shade pipe to 60 degrees except at the joints. Complete the interior weld prior to coating the outside joint.
- D. If joint laying surfaces are rusted or pitted where weld metal is to be deposited, clean them by wire brushing or sand blasting.
- E. Complete the butt-welded longitudinal seams of butt-straps before completing circumferential fillet welds. Grind the backing bar clear of abutting pipe section prior to completing circumferential fillet welds. Backing bars shall be left in place.
- F. Completed fillet welds shall be convex with a maximum reinforcement of 1/8 inch. Minimum leg length shall be the sum of the greatest abutting plate thickness plus joint clearance. Equalize joint clearance around entire circumference prior to welding. Remove all tack welds prior to the start of joint welding.
- G. Preheat the joints to be welded where required in accordance with Table 1 of AWWA C206.
- H. Where weld metal is to be deposited, clean joints by wire brushing or sand blasting. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.
- I. No welding ground shall be made on the coated part of the pipe.
- J. In all hand welding, the metal shall be deposited in successive layers so that there will be at least as many passes or beads in the completed weld as indicated in the following table:

Steel Cylinder Thickness (Inches)	Fillet Weld, Minimum Number of Passes
3/16 or Less	1
7/32 Through 1/4	2
9/32 Through 3/8	3
13/32 Through 1/2	4
More Than 1/2	1 For Each 1/8 Inch and Any Remaining Fraction Thereof

- K. The plate edges shall be so prepared that there will be sufficient angle in the welding groove to prevent side arcing of the electrode and to permit penetration at the deepest point of the groove. All such welds shall be back-chipped with a round-nosed tool to clean metal on the reverse side from the

side of the deepest penetration before any welding is done on said reverse side. Each hand pass and each back-chipped welding groove shall be subject to inspection before the ensuing pass is made. Each hand pass shall be the full width of the weld.

- L. Not more than 1/8 inch of metal shall be deposited in each pass. Each pass, whether in butt or fillet welds, shall be thoroughly brushed or hammered to remove dirt, slag, or flux before the succeeding bead is applied. Each pass shall be thoroughly fused into the plates at each side of the welding groove or fillet and shall not be permitted to pile up in the center of the weld. Undercutting along either side will not be permitted.
- M. Complete each pass around the entire circumference of the pipe before commencing the next pass. Use the electrodes recommended by the pipe fabricator. Do not deposit more than 1/8 inch of throat thickness per pass.
- N. During welding exterior welds, the coating of welded steel pipe shall be protected by draping an 18-inch-wide strip of heat-resistant material over the top half of the pipe on each side of the coating holdback to avoid damage to the coating by hot weld splatter. No welding ground shall be made on the coated part of the pipe.

3.09 PIPELINE CLOSURE ASSEMBLIES

- A. Use pipeline closure assemblies to unite sections of pipeline laid from opposite directions and to adjust the field length of the pipeline to meet structures, other pipelines, and points established by design stations. The minimum length of pipe closure sections shall be 4 feet.
- B. Use pipeline closure assemblies between butt-welded pipeline sections and double-welded pipeline sections.
- C. Center the shaped steel butt straps over the ends of the pipe sections they are to join as shown on the drawings.
- D. Cement-mortar line closure assemblies to a mortar thickness at least equal to the adjoining standard pipe sections. Clean the steel with wire brushes and apply a cement and water wash coat prior to applying the cement mortar. Where more than a 4-inch joint strip of mortar is required, place welded wire mesh reinforcement in 2-inch by 4-inch pattern of No. 13 gage over the exposed steel.

Install the mesh so that the wires on the 2-inch spacing run circumferentially around the pipe. Crimp the wires on the 4-inch spacing to support the mesh 3/8 inch from the metal surface. Steel-trowel finish the interior mortar to match adjoining mortar lined pipe sections.

Coat the exterior of closure assemblies to match adjacent specified pipe joint coating.

- E. Field trimming of pipe shall be normal to the axis of the pipe only.
- F. No angular deflections will be allowed at butt strap joints.

3.10 COMPLETION OF INSIDE MORTAR JOINTS

- A. Cement mortar used for the joints shall be composed of a minimum of one part cement to not more than two parts sand, by weight, dry mixed, and moistened with sufficient water to permit packing and troweling without crumbling. Water shall be clean and free from injurious quantities of organic matter, alkali, salts, and other impurities and shall meet the requirements of Section 02223.
- B. Backfill the trench before applying interior lining at field welded joints.
- C. Working inside the pipe, remove foreign substances which adhere to the steel joint rings, clean them, and pack cement mortar into each joint. Before placing the joint mortar material against the surfaces of the lining, the surfaces shall be carefully cleaned, have all soap removed, and then be wetted to

provide a good bond between the lining and the joint mortar. Finish the surface with a steel trowel to match the adjoining pipes.

- D. Remove excess mortar and other construction debris from the pipe interior.

3.11 COMPLETION OF EXTERIOR PIPE JOINT

- A. Coat the exterior of welded steel and concrete cylinder pipe joints as shown on the drawings.
- B. Apply cement mortar coating and reinforcement to field joints as shown on the construction plans. Before placing the reinforced mortar coating the braces in the bare end of the pipe shall be temporarily removed. Exterior coating at welded joints shall be applied within 1 day after weld testing. Field joints in exterior mortar coating shall be made either by pneumatically applying or by pouring mortar in a suitable diaper. Pneumatically applied mortar at field joints shall have a minimum thickness of 1 inch. Poured mortar at field joints shall overlap the adjacent pneumatically applied mortar coating a distance of not less than 5 inches, and the thickness of the poured mortar shall be not less than 1-1/4 inches. Diapers shall be polyethylene foam-lined fabric with steel strapping of sufficient strength to hold the fresh mortar, resist rodding of the mortar and allow excess water to escape. The foam plastic shall be 100 percent closed cell, chemically inert, insoluble in water and resistant to acids, alkalis and solvents. The Engineer may order the diapers to be removed for inspection prior to backfilling.
- C. Start the backfilling operations specified in Section 02223 immediately after coating the field joints.
- D. Do not remove the cross bracing in pipe to be encased until the encasement has cured at least seven days and the subsequent backfill is completed.

3.12 PIPE BACKFILL

- A. Provide thrust blocks for rubber gasket joints 16-inches in diameter or less per Standard Drawings.
- B. Provide sufficient space along each side of the pipe and the trench wall to observe that the backfill material fills all spaces below pipe spring line under the pipe haunches.

3.13 PROTECTION OF MORTAR LINING

Until the pipeline is filled with water, install bulkheads and apply moisture inside the bulkheaded portions in a manner that will effectively prevent the drying out of the mortar lining.

PART 4 - PAYMENT

Payment of the work in this section will be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15051

SECTION 15057

COPPER PIPE AND FITTINGS

PART 1 – GENERAL

1.01 Description

- A. This section describes materials, installation, and testing of copper and brass pipe, and copper, brass and bronze fittings and appurtenances.

1.02 Related Work Specified Elsewhere

- A. Trenching, Backfilling, and Compacting: 02223.
- B. Painting and Coating: 09900
- C. Hydrostatic Testing of Pressure Pipelines: 15042.
- D. Installation of Pressure Pipelines: 15051.
- E. Valves: 15100.

1.03 Submittals

- A. Shop drawings shall be submitted in accordance with Section 01300 and the following:
- B. Submit detailed layout if copper pipe runs exceed 50 lineal feet.
- C. Submit catalogue order sheets for materials of pipe, flanges, flange insulation kits, companion flanges and unions, showing metal composition and conformance to industry standards (ASTM, etc.) specified.

PART 2 - MATERIALS

2.01. Copper Pipe and Tubing

- A. Copper piping shall conform to ASTM B 88. Copper pipe and tubing shall be cylindrical, of uniform wall thickness, and shall be free from any cracks, seams, or other defects. Piping located above floors or suspended from ceilings shall be Type L. Piping buried or located beneath floor slabs shall be Type K. Copper pipe shall be as manufactured by Halstead, Mueller, or for contracts between Owner and Contractor, approved equal.

2.02. Copper Fittings

- A. Copper fittings shall be copper conforming to ASTM B 75 and ANSI B16.22, with solder end joints. Fittings 3/8-inch and smaller may have flared end connections or compression joint connections.

2.03. Solder

- A. Solder shall be tin-silver solder conforming to ASTM B 32, latest revision, Grade Sn94, Sn95 or Sn96. Cored solder shall not be used. Solder and flux used in joints of potable waterlines shall contain no lead.

2.04. Brass Pipe and Nipples

- A. Short threaded nipples and brass pipe shall conform to ASTM B 43, regular wall thickness, except that nipples and pipe of sizes 1 inch and smaller shall be extra strong. Threads shall conform to ANSI B1.20.1. Brass material shall conform to ANSI/AWWA Standard C800, latest revision, with a maximum lead content of 0.25% by average weight.

2.05. Appurtenances

- A. General: All items manufactured of bronze shall conform to ASTM B62, "Composition Brass or Ounce Metal Castings." All items manufactured of brass shall conform to ANSI/AWWA Standard C800, latest revision, with a maximum lead content of 0.25% by average weight.
- B. Service Saddles: Service saddles shall be tapped with a female iron pipe thread outlet. The seal with the pipe outer wall shall be either a rubber gasket or an O-ring. Service saddles shall be as manufactured by Jones, Mueller, Ford, or for contracts between Owner and Contractor, approved equal.
 - 1. Service saddles shall be the double strap type for all sizes of asbestos- cement or ductile iron pipe. The straps (or bails) shall be flat and shall be manufactured of Everdur or Silnic bronze or stainless steel.
 - 2. Service saddles for C900 PVC pipe shall be cast in two sections for pipe up to and including 8-inches in diameter. Service saddles for use on 10-inch and 12-inch diameter C900 PVC pipe may be cast in two or three sections. Each saddle shall accurately fit the contour of the pipe O.D. without causing distortion of the pipe. The sections shall be securely held in place with Type 316 stainless steel hex-head screws or bolts. Casting sections may be hinged and secured with stainless steel pins. The casting sections shall be tapped to receive the screws or bolts.
- C. Corporation Stops: The inlet fitting of the corporation stop shall be a male iron pipe thread when used with a service saddle and the outlet connection shall be a pack joint compression type. Corporation stops shall be of the ball valve type as manufactured by Jones, Mueller, Ford, or for contracts between Owner and Contractor, approved equal. Insulated corporation stops shall be used on ductile iron and steel pipelines. See Standard Drawings W-1 and W-2.
- D. Angle Meter Stops: The inlet connection of the angle meter stop shall be a pack joint compression type and the outlet fitting shall be a meter flange or meter swivel nut. The inlet and outlet shall form an angle of 90 degrees on a vertical plane through the centerline of the meter stop. A rectangular lug and lock wing shall be provided on the top of the fitting to operate the shutoff mechanism. Two-inch angle meter stops shall be with "slotted" holes for 2- inch meters. Angle meter stops shall be as manufactured by Jones, Mueller, Ford, or for contracts between Owner and Contractor, approved equal.
- E. Customer Service Valve (OPTIONAL): Customer service valves shall be manufactured with a lever-type turn handle. The valve inlet connection shall be a female iron pipe thread for the ¾-inch and 1-inch meters. The valve inlet connection shall be a male iron pipe thread for the 1½-inch and 2-inch meters. Recommended customer service valve manufacturers include Jones, Ford, or equal.

2.06. Insulating Bushings and Unions

- A. Pipe fittings, and appurtenances (air vacs, pressure gauges, etc.) made of dissimilar metals shall be isolated from each other by means of nylon insulating pipe bushings, insulating unions, or insulating couplings. Insulating bushings, unions, and couplings shall be as manufactured by Pipeline Coating and Engineering Company, Smith-Blair, Pipe Seal and

Insulator Company, or for contracts between Owner and Contractor, approved equal. For applications where pipeline pressures exceed 150 psi, and where the pipe tap for the appurtenance into the main is larger than 1-inch in diameter, a 2½-inch extra heavy carbon steel coupling shall be provided as the outlet, and the fitting/ appurtenance shall be isolated from the main by means of a 2-inch Type 316 stainless steel bushing, 2-inch Type 316 stainless steel nipple, and 2-inch stainless steel ball valve.

2.07. Flanges, Gaskets, Bolts and Nuts

- A. Flanges for Valves and Fittings: Copper pipe shall be connected to flanged valves and fittings with bronze flanges conforming to ANSI B16.24, Class 125 or Class 150, to match the connecting flange. Solder end companion flanges shall be used for copper and thread companion flanges shall be used for brass, bronze or stainless steel pipe connections.
- B. Gaskets: Gaskets for flanged-end fittings shall be made of synthetic rubber binder and shall be full-face, 1/8-inch thick Johns-Manville 60, John Crane Co. "Cranite", or for contracts between Owner and Contractor, approved equal.
- C. Flanged Connections: All flanged connections shall be made using Type 316 stainless-steel bolts and nuts conforming to ASTM A 193, Grade B8M for bolts and ASTM A 194, Grade 8M for nuts. Washers shall be provided for each nut. Washers shall be of the same material as the nuts.

2.08. Union

- A. Unions for copper piping systems (non-buried applications) shall conform to the following. Union shall be the same size as the pipe, and shall be of the three part type, with silver soldered "sweat" hub-end connections. Unions shall be bronze, conforming to ASTM B 61 or B 62. Dielectric unions shall be used when connecting copper pipe to ferrous metals. Unions shall be Mueller H-15403, Jones J-1528, or for contracts between Owner and Contractor, approved equal.

PART 3 – EXECUTION

3.01. General

- A. Pipe shall be installed without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipments. Pipe hangers and supports, and pipe penetrations through walls, slabs, and floors shall be as detailed on the drawings.

3.02. Installing Flange Bolts and Nuts

- A. Bolt Thread Lubrication: Bolt threads shall be lubricated with anti-seize compound prior to installation. Anti-seize compound shall be manufactured by Tri-Flow, Permatex or Crouse-Hinds.
- B. Flange Alignment: Flanges pipe shall be set with the flange bolt holes straddling the pipe horizontal and vertical centerlines.

3.03. Installation

- A. Related Installation Specification: Pipe shall be installed in accordance with the requirements of Section 15051, Installation of Pressure Pipelines.
- B. Pipe/Tubing Preparation: Tubing shall be cut square and burrs removed. Both the inside and outside of fitting and pipe ends shall be cleaned with steel wool and muriatic acid before soldering. Care shall be taken to prevent overheating (or annealing) of fittings and tubing when

making connections. Miter joints shall not be permitted in lieu of elbows. Notching straight runs of pipe in lieu of tees shall not be permitted.

- C. Pipe Bends: Bends in soft copper tubing shall be long sweep. Bends shall be shaped with shaping tools. Bends shall be formed without flattening, buckling, or thinning the tubing wall at any point.
- D. Brazing: Brazing procedures shall be in accordance with Articles XII and XIII, Section IX, of the ASME Boiler and Pressure Vessel Code. Solder shall penetrate to the full depth of the bell in joints and fittings. Solders shall comply with ANSI B31.3, paragraph 328.
- E. Polyethylene Encasement: Buried copper piping shall be encased with a minimum 6-mil-thick polyethylene sleeve. Service saddles shall be wrapped with a minimum 8-mil-thick polyethylene encasement.
- F. Pipe Flexibility and Minimum Cover for Service Lines: Buried piping shall be installed with some slack to provide flexibility in the event of a load due to settlement, expansion or contraction. A minimum cover of 30-inches below the finished top of curb shall be adhered to. The tubing shall be bedded and covered with sand or select material in accordance with Section 02223.
- G. Three-Quarter-inch and One-inch Service Laterals: All $\frac{3}{4}$ -inch and 1-inch services shall be installed with soft copper tubing Type K. End connections for the corporation stop and angle meter stop shall be compression type fittings. All other couplings, fittings and joints shall be silver soldered. See Standard Drawing W-1.
- H. One-and-a-Half-inch and Two-inch Service Laterals: All $1\frac{1}{2}$ -inch and 2-inch size services shall be installed with straight lengths of copper water tube Type K. End connections for the corporation stop and angle meter stop shall be compression type fittings. The 45° and 90° fittings shall be compression type and of no-lead to low-lead brass material. All other couplings and adapters shall be silver soldered. See Standard Drawing W-2.

3.04. Service Saddles

- A. Proximity to Valves, Couplings, Joints, and Fittings: Service saddles shall be no closer than 18-inches to valves, couplings, joints, or fittings unless it is at the end of the main. The installation of a service saddle on any machined section of asbestos cement pipe will not be permitted.
- B. Pipe Surface Preparation: The surface of the pipe shall be cleaned, smoothed and de-burred to remove all loose material and to provide a hard, clean surface before installing the service saddle.
- C. Installation: The service saddle shall be tightened firmly to ensure a tight seal; however, care shall be used to prevent damage or distortion of the pipe by overtightening.
- D. Pipe Tap: The tap into the pipe shall be made in accordance with the pipe manufacturer's recommendation.

3.05. Pipe Coatings

- A. Buried pipe may be coated with cold applied laminated polyethylene/rubberized bitumen coating, with liquid adhesive prime coat. Minimum total coating thickness shall be 35 mils (7-mil polyethylene backing plus 28-mil rubberized bitumen adhesive). Tape shall be applied in the form of 2 or 4-inch wide tape wrap after the primer has dried. Tape shall be applied spirally with a minimum overlap of $\frac{3}{4}$ -inches for 2-inch wide, and 2-inches for 4-inches wide tape. The primer shall be applied at an average rate of 400 square feet per gallon. Tape

shall be Polyguard 600 (35 mil) with Polyguard 600 liquid adhesive primer.

PART 4 – PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15057

SECTION 15076 CEMENT-MORTAR LINED AND COATED STEEL PIPE

PART 1 - GENERAL

A. Description

Supply cement-mortar lined welded steel pipe with fittings and special pieces, fabricated in accordance with AWWA C200, C203, C214, C209, and C205 and the following options and restrictions. Provide qualification of pipe fabricator to provide completed lined and coated pipe. See Section 15010 for yard pipe 16 inches in diameter and smaller.

B. Specials

A special is defined as any piece of pipe other than a normal full length of straight section. This includes elbows, manhole sections, reducers, adapter sections with special ends, sections with outlets, closure sections, etc.

C. Qualifications of Manufacturers

Only manufacturers who manufacture a completed lined and coated pipe can be qualified for project work. All operations shall be performed at the same location for any piece of pipe. Supervisors of cement-mortar coating operations shall have at least two years continuous recent experience in the application of cement-mortar coating systems for steel pipe.

D. Submittals

1. Submit shop drawings in accordance with the General Provisions.
2. Submit pipeline layout including:
 - a. The location, length, plate thickness, and designation by number of each steel pipe section and fabrication.
 - b. The invert station and elevation to which the spigot end of each pipe, within the limits of horizontal or vertical curve, will be laid.
 - c. The elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflections in cases of combined curvature.
 - d. The limits of each reach of each type of field-welded joint and of concrete encasement.
 - e. Locations of longitudinal and circumferential joints in the pipe, fabricated fittings, and outlets.
 - f. Details and locations of bulkheads for hydrostatic testing of pipeline.
 - g. Details and locations of closures for length adjustment and for construction convenience.

3. Submit details of specials and fittings.
4. Submit details of butt straps which are to be shipped separately.
5. Submit certified copies of mill test reports on each heat from which steel is rolled. Tests shall include physical and chemical properties. Submit certified copies of mill test reports for flanges including details of stress relief used.
6. Submit dimensional check reports on each steel pipe section after fabrication.
7. Submit certificates of welding rods used for shop and field welding. Submit welder qualifications including welding procedure specifications and procedure qualification records.
8. Submit test reports on physical properties of rubber used in the gaskets.
9. Submit points of access and schedule for placement of mortar lining and removal of test bulkheads.
10. Cement: Submit statement from the supplier that the cement delivered to the work complies with the specifications.
11. Sand: Submit sieve analysis, ASTM C 136; test of organic impurities in sands for concrete, ASTM C 40; test of the effect of organic impurities in fine aggregate on the strength of mortar, ASTM C 87.
12. Submit affidavits of compliance with referenced standards (e.g., AWWA C200, C203, etc.) with each required submittal.
13. Pipe fabrication schedule is an integral part of Contractor's schedule. Provide details of pipe fabricator's schedule for pipe fabrication, coating, lining, number of plants, location of plants, and type of pipe, thickness, etc. to allow Owner time to schedule inspectors.

PART 2 - MATERIALS

A. Design Criteria

1. Obtain the following information from the drawings:
 - a. Elevation of the pipe invert and of the final ground surface.
 - b. Alignment of the pipeline.
 - c. Nominal internal diameter, after cement-mortar lining.
 - d. Pipe wall thickness.
 - e. Locations of double-welded and butt-welded joints.
2. Pipe Design Pressure: Design pressure is the pressure class shown on the construction plans.
3. Field Hydrostatic Test HGL: As indicated in Section 15042.

4. Special With Outlets

- a. Design and fabricate specials with outlets in accordance with the following table:

$$R = \frac{\text{ID outlet}}{\text{ID cyl.} \times \sin B}$$

B = Angle between the longitudinal axis of the main run and the branch

F = Allowable design stress

FY = Minimum yield stress of steel

<u>Max. R</u>	<u>Main Run Max. ID</u>	<u>Type Fabrication</u>
0.3	No limit	Outlet reinforcing collar welded to steel cylinder. Use $F = 0.5 \times FY$.
0.5	No limit	Outlet reinforcing collar welded to steel cylinder. Use $F = 0.4 \times FY$.
0.7	48 in.	Steel special with reinforcing wrapper plate. Use $F = 0.4 \times FY$.
No limit	120 in.	Steel special with crotch plate. Use $F = 0.4 \times FY$.

When outlets are located opposite each other in a special (i.e. a cross), the limiting values of "R" shall be 0.15, 0.25, and 0.35, respectively.

- b. For collar reinforcement, select an effective shoulder width "W" of a collar from the inside surface of the steel outlet to the outside edge of the collar, measured on the surface of the cylinder, such that:

$$W = (1/3 \text{ to } 1/2) \times \frac{\text{ID outlet}}{\sin B}$$

The minimum thickness "T" of the collar is determined by:

$$T = \frac{P \times \text{ID cyl.} \times \text{ID outlet} \times 2 - \sin B}{4 \times F \times W \times \sin B}$$

where: P = Design pressure
F, B = As in part A.4.a.

Collars may be oval in shape or rectangular with rounded corners.

- c. For a wrapper plate, use the above collar formula, except that the wrapper is of thickness "T", its total width is $(2W + \text{ID outlet}/\sin B)$, and it extends entirely around the main pipe portion of the steel special.

- d. Base crotch plate design on Swanson H.S., et al., Design of Wye Branches for Steel Pipe, which is summarized in AWWA Manual M11, Chapter 13 (1989 edition).

B. Cement for Mortar Lining

ASTM C 150, Type II for mortar lining.

Additional requirements for field-placed mortar lining:

- 1. Natural cement shall conform to ASTM C 10, Type N.
- 2. Pozzolanic material shall conform to the requirements of ASTM C 618, Class N, with the following exceptions:

<u>Material</u>	<u>Percent</u>
Sulfur trioxide (SO ₃), maximum percent	4
Pozzolanic activity index:	
With portland cement, at 28 days, minimum percentage of control	85
With lime, at 7 days, minimum, psi	950
Water requirement, maximum, percentage of control	110
Reactivity with cement alkalies:	
Reduction of mortar expansion at 14 days, minimum, percent	85

C. Cement Mortar Coating

The materials for exterior mortar coatings, whether application is by pneumatic or other approved methods, shall conform to the provisions specified herein.

- 1. Cement: Cement shall be furnished by the Contractor and shall be type II low alkali, conforming to the requirements of ASTM Standard C 150. Unless otherwise permitted by the Owner, all cement shall be procured from the same mill. Owner shall be furnished with 3 certified copies of reports from the company supplying the cement, stating that the cement delivered to the work complies with the Specifications.
- 2. Sand: Sand for pneumatically applied mortar shall consist of natural sand obtained from approved pits and shall in all cases be washed. The control of the washing of sand shall be such that the finer particles are retained or removed as required. Washed or saturated sand shall be allowed to drain at least 24 hours to a uniform moisture content before batching. Dry sand shall be moistened before handling when necessary to prevent segregation. The sand shall be screened through a horizontal vibrating screen having square openings, and the grading as determined in accordance with the methods prescribed by ASTM Standard C 136 shall be within the following limits:

<u>Sand</u>	<u>PERCENT</u>
Passing a 3/4-inch square sieve	100
Passing a No. 4 sieve	90 to 100
Passing a No. 8 sieve	65 to 90
Passing a No. 16 sieve	45 to 75
Passing a No. 30 sieve	30 to 50
Passing a No. 50 sieve	12 to 22
Passing a No. 100 sieve	2 to 8
Passing a No. 200 sieve	0 to 4

The difference between the percentages passing the No. 30 and the No. 50 sieves shall not exceed 32.

Sand shall be composed of clean, hard, strong, durable, uncoated grains, free from shale, lumps, and soft or flaky particles and from injurious amounts of dust, alkali, organic matter, loam, mica, or other deleterious substances. When tested in accordance with the methods prescribed by ASTM Standard C 40, the color of the supernatant liquid shall not be darker than the standard specified therein, and shall not contain more than a total of 3 percent by volume of clay, silt, mica, or other objectionable inorganic materials, as determined by settlement after thoroughly mixing and shaking the sample with 2-1/2 times its volume of a 3 percent (by weight) solution of sodium hydroxide in a graduated column.

Sand which in any respect varies from the foregoing requirements shall not be used in the work, and the Contractor shall do sorting, crushing, screening, blending, washing, and other operations necessary to make the available material conform to said requirements and shall receive no extra compensation therefor, nor for the necessity of separating and wasting any part of the natural materials. In case the finer particles from the crushed coarse aggregate are permitted or required to be mixed with the sand from natural deposits, the two products shall be uniformly blended before washing or screening to insure a combined product of constant composition.

Sand as prepared for use shall be of such quality that 2-inch by 4-inch mortar cylinders made with a mixture of cement and the sand under test shall develop compressive strengths at 7 and 28 days of not less than 90 percent of those developed by a mortar prepared in the same manner with the same cement and graded Ottawa testing sand, all in accordance with the method prescribed in ASTM Standard C 87.

3. Water: Water for pneumatically applied mortar shall be furnished by the Contractor. All water shall be clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities which, in the opinion of the Engineer, might reduce the strength, durability or other quality of the pneumatically applied mortar. The following limits for total dissolved solids and chlorides shall not be exceeded:

- a. Total dissolved solids shall not exceed 1,000 milligrams per liter (mg/l) when tested in accordance with ASTM Standard D 1888, method A:
 - b. Chloride content as cl- shall not exceed 200 mg/l;
 - c. pH shall not be less than 6.5 when tested in accordance with ASTM Standard D 1293.
4. **Mixing:** The sand and cement shall be thoroughly mixed in a dry state before being deposited in the placing machine or its hopper. Machine mixing will be required unless specific authority to use hand mixing is given by the Engineer. The machine and its operation shall continue for a period of not less than 1 minute after all sand and cement is placed in the mixer. The sand shall contain or be moistened with 5 to 10 percent of water by volume and shall not be mixed with the cement until just before placing in the hopper in order to insure against partial setting of the cement. Dry-mixed materials shall be used promptly after mixing. Any materials that remain in the hopper longer than 45 minutes after mixing shall be discarded. Rebound, recovered clean and free of foreign matter and otherwise in acceptable condition for reuse, may be reused as sand in a quantity not to exceed 20 percent of the total sand requirements.

D. Reinforcement for Mortar Lining of Specials

Additional reinforcement used for patching and joining cement mortar lined pipe shall meet the following requirements:

Reinforcement shall be Size W-1 welded wire fabric conforming to ASTM A 185. Spacing shall be 2 inches center to center for longitudinal members and 4 inches center to center for transverse members (2x4-W1xW1). The wire need not be galvanized. Wire designated No. 12 on the American Steel and Wire Gage scale may be substituted for the size specified above. Do not use excessively rusted fabric. Installed fabric shall be free from dirt and paint or other coating material.

E. Sheet Steel or Plate and Minimum Yield Point -

The following shall be used for pipe 14-inches in diameter or larger

1. ASTM A 283, Grade D (33,000 psi); ASTM A 570, Grade 33 (33,000 psi).
2. Order the steel plate and sheet by thickness with a maximum allowable variation of not more than 0.01 inch less than the thickness specified. If coils thicker than 0.2299 inch are used, they shall satisfy the chemical, tensile, bend test, and all other requirements of ASTM A 570, Grade 33.
The carbon content shall not exceed .25 percent. Tests performed on 8-inch tension specimens shall show elongations not less than 18 percent. The cold working of steel plate to obtain the specified tensile requirements will not be permitted. Any laminations or other defects shall be cause for rejection.

F. Structural Steel for Outlet Reinforcement

ASTM A 36.

G. Mill-Manufactured Steel Pipe (Approved for all sizes)

ASTM A 53, Grade B or A 106, Grade B. Minimum wall thickness shall be standard weight, ANSI B36.10.

H. Flanges

Flanges, bolts, studs, nuts and gaskets shall be in accordance with Section 15051.

I. Type of Pipe Ends

Type of pipe ends shall be carnegie bell and spigot, single welded lap joints, flanged joints or butt-strap joints as shown on the construction plans. All non-welded joints shall be bonded as shown on the construction drawings.

J. Welding Fittings

Welding fittings shall be butt-weld wrought carbon steel fittings conforming to ASTM A 234, Grade WPB. Minimum thickness shall equal the thickest matching pipe.

K. Threaded Openings

1. Threaded openings shall be less than 2 1/2 inches, in nominal size, and shall be a standard weight, stainless steel flat-bottom, threaded welding outlet. Where the mounting surface is curved to a diameter of 36 inches or less, the mounting diameter shall be the same as that of the surface upon which it is to be mounted.
2. The threaded outlet and its plug shall be forged from stainless steel conforming to ASTM A 240. The outlets shall be thread-o-lets.

L. Welding Outlets

Welding-type outlets shall have a mounting diameter the same as that of the surface upon which they are to be mounted. Where the mounting surface is curved to a diameter of 36 inches or more, the outlet bottom may be flat. Welding-type outlets shall be forged from stainless steel conforming to the requirements specified for threaded outlets. The outlets shall be weld-o-lets.

M. Exterior Coating

1. All buried steel pipe shall be cement-mortar coated in accordance with AWWA C205
2. Pipe located above ground or in vaults and structures shall be painted in accordance with Section 09900. Primer shall be shop applied.

PART 3 - EXECUTION

A. Diameter and Length of Pipe Sections

1. The nominal diameter or inside diameter of the pipe and other fabricated steel sections as shown on the drawings is the clear diameter of the lined pipe after the application of interior mortar lining.
2. The length of standard sections of pipe shall be from 30 to 40 feet.

B. Pipe Cylinder Fabrication

1. Longitudinal and Girth Seams: Fabricate the pipe cylinder by butt welding, spiral seam, or straight seam. When using straight seams, fabricate pipe with either a single longitudinal seam and multiple courses of from 7 feet 6 inches to 10 feet, or else with a single course having not more than the number of longitudinal seams shown in the following table:

<u>Pipe Nominal Diameter (inches)</u>	<u>No. of Seams</u>
24 to 60	2
61 to 90	3
91 to 120	4

Where more than one longitudinal seam is used, the plates shall be of equal widths. Stagger equally the longitudinal joints of adjacent courses.

When using spiral seams, coil splices shall be a minimum of 2 feet away from the ends of the pipe cylinder.

2. Preparation of Edges: Machine or face the ends and edges of pipe sections for butt welds. Inspect sheared edges of plates or sheets over 1/4 inch in thickness for cracks. Do not use plates or sheets with edges containing cracks.

If the ends are faced with a cutting torch, remove irregularities and scale due to burning by grinding or chipping.

The dimensions and shape of the edges of the plates to be joined by welding and the gap between the plates shall be such as to allow thorough fusion and complete penetration, and the edges of plates shall be properly formed to accommodate the various welding conditions. Remove projecting burrs. Do not use hammering to shape the edges preparatory to welding.

Cut plates true to line so that the edges, when in position for welding, shall be straight, parallel, and in contact on longitudinal seams.

The maximum gap between the edges of plates prior to welding shall not be more than 1/16 inch.

3. Forming

- a. General: Before rolling or forming longitudinal edges, plates shall be lap broken by a continuous rolling operation or be formed in a press having dies that are machined to the proper radius. The pressure exerted during the lap breaking operation shall be sufficient to secure a true and uniform curve at the edges of the plate. Roll or press form plates to the specified diameter.

Continually remove scale and other foreign matter accumulating on the plate during the rolling and forming operation by an air blast so that it will not be rolled or pressed into the surface of the plate. Keep the surfaces of breaker dies and rolls clear of bits of metal or other accumulated materials during forming operations.

Form each section of pipe to a true circle of the specified diameter throughout its entire length so as to produce a finished pipe truly round and free from dents, kinks, and abrupt changes in curvature. The outside circumference of the finished pipe shall not be less than its design value and shall not exceed its design value by more than 0.4 percent.

Complete rolling and forming prior to making butt welds.

Do not heat or hammer for the necessary forming of angles.

- b. Minimum Radius: Do not use any forming process in which the plates are bent or otherwise formed during any stage of the process to a curvature of appreciably smaller radius than the radius of curvature corresponding to the specified diameter of the pipe.
- c. Forming Bells: Shape the bells to accommodate the spigot penetration shown on the drawings or specified herein. Form the bell on an expanding press or by being thrust axially over a die in such a manner as to stretch the steel plate beyond its elastic limit to a round bell of required diameter and shape, avoiding injurious reduction in plate thickness at any point, and avoiding impairment of the physical properties of any part of the plate.

Do not use any process in which the bell is formed by rolling. The axis of the bell shall be parallel to the axis of the pipe and eccentricity of said axis shall not be greater than 1/8 inch.

Bells for mitered pipe shall be normal to the axis of the adjacent course of the adjoining pipe, and the axis of any such bell shall be parallel to the axis of such adjacent course.

- d. At the ends of straight sections of pipe, including those with ends mitered for vertical curvature, and at the ends of shop bends for vertical curvature, the interior circumferential length of the bell shall be not less than the exterior circumferential length of the spigot, and the difference between the lengths shall not exceed 3/16 inch. Pipe joints shall be checked in the plant by

stabbing joints from time to time, and as directed by the Owner's Representative to insure proper fit.

- e. In the case of all shop fabricated bends for horizontal curvature, all straight sections with ends mitered for horizontal curvature, and all straight sections less than 15 feet in length, the interior circumferential length of the spigot, and such difference in circumferential length shall not be less than 1/16 inch and not greater than 3/16 inch.
- f. Stress-Relieving
 - 1) Stress-relieving of carbon steel parts, where required by the latest edition of the ASME Boiler and Pressure Vessel Code, Section VIII, and where specified herein, shall be done by heating the required parts to between 1100 and 1200 degrees Fahrenheit in a suitable furnace with adequate temperature control. The furnace temperature shall be brought slowly up to the required temperature and be held at that temperature for at least 1 hour per inch thickness of the thickest part, but in no case less than 1 hour. The section shall be allowed to cool slowly in accordance with the applicable requirements of the latest edition of the ASME Boiler and Pressure Vessel Code, Section VIII, Unified Pressure Vessels. Furnaces shall have temperature recorders, and three (3) copies of the charts of the stress-relieving temperatures used shall be furnished to the Engineer.
 - 2) All parts to be welded shall be adequately supported throughout any preheating, welding, and stress-relieving operations to prevent deflection or distortion.

4. Preparation for Welding

- a. Fit Up: Take special care in the layout of joints in which fillet welds are to be used in order to ensure the fusion of the weld metal or material at the bottom of the fillet. Prior to welding, fit the plates closely; and during welding, hold them firmly together.

Tack weld or clamp in place the edges of butt joints in proper alignment and so hold throughout the welding process. Do not use dogs, clips, lugs, or equivalent devices welded to the steel plate for the purpose of forcing it into position.

- b. Cleaning: Prior to welding, clean the surfaces of plates and members to be welded by an automatic process of all scale and rust for a distance of not less than 1 inch and of all oil or grease for a distance of not less than 3 inches from the welding edge and on both sides of the plates in the case of butt joints.

Remove grease or oil with lye or other solvent. Do not use kerosene or any heavier petroleum solvent.

Blasting and other cleaning shall preferably be done prior to any tack welding of the plates. Should inspection indicate a greater amount of porosity at the tack welds than in the remainder of the welds, sandblast the tack welds prior to automatic welding.

When it is necessary to deposit metal over a previously welded surface, remove any scale, slag, or welding flux thereon by a roughing tool, chisel, air chipping hammer, or other means to prevent inclusion of impurities in the weld metal.

Back-chipping of automatic welds will not be required for an Engineer's approved automatic welding process which utilizes an automated flux backing method that provides for a tightly packed flux backup; however, all welding grooves shall be cleaned as specified and the fit-up tack welding shall be completely removed.

- c. **Aligning:** Where butt-welded joints are used, take particular care in aligning the edges to be joined so that complete penetration and fusion at the bottom of the joint is accomplished. The offset in abutting edges shall not exceed 1/16 inch at circumferential and spiral seams and shall not exceed 1/32 inch at longitudinal seams.

For plates over 1/2 inch thickness, if thickness of two adjacent plates are different by more than 1/8 inch, the thicker plates shall be trimmed to a smooth taper extending for a distance of at least 4 times the offset between abutting surfaces so that adjoining edges will be approximately the same thickness. The length of the required taper may include the width of the weld.

5. Welding

- a. **Material and Objective:** Perform welding by skilled welders who have had experience in the method and materials to be used. Welding operators shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications. Any welder or welding operator performing work shall have been qualified for the process involved within the past three years.

Perform welding by an unvarying arc-welding process, which excludes the atmosphere during the process of deposition and while the metal is in a molten state. The size and type of electrode used, the current and voltage required, and the type of wire and flux to be used for automatic processes shall be subject to review by the Engineer.

Do not use rusted or damaged electrodes. Sift used flux from automatic welders free of fines and coarse pieces and remove mill scale before reusing.

Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Make welds with a technique which will ensure uniform distribution of load throughout the welded section with a minimum tendency to produce eccentric stress or distortion in the weld or in the adjacent metal.

Make all welds in such manner and on such time schedule as to avoid residual internal stresses in the welded joints and stresses due to temperature changes in the completed pipelines. Weld longitudinal seams before girth seams.

- b. Quality of Welds: There shall be no greater evidence of oxidation in the metal of the weld than in the metal of the unwelded plate. Welded joints shall be of a type that will produce complete fusion of the plates and shall be free from unsound metal, pinholes, and cracks.

The finish of welded joints shall be reasonably smooth and free from grooves, depressions, burrs, and other irregularities. There shall be no valley or undercut in the center or edges of any weld.

Any pipe section which shows irregularities in shape after welding may be rerolled to make it cylindrical, but in no case shall it be reformed by hammering, and in no event shall reforming be permitted of pipe sections which after welding are found to have abrupt changes in curvature at longitudinal seams, unless such welds are subsequently removed and rewelded following the reforming operation.

Back chipping on both automatic and hand welding, whether for repairs or preparation of the groove for the original weld, are subject to inspection by the Engineer before being filled with weld metal. Do not make butt welds prior to the completion of the rolling and forming. Grind butt welds for both hand and automatic welding to sound metal before welding the reverse side.

- c. Longitudinal Joints: Longitudinal joints shall be double butt welded by an approved fully automatic welding process, using welding heads which permit visual investigation of the deepest point of penetration of the first pass and which permit backfilling of extensive repair cuts by the automatic process. Use starter and runoff plates for longitudinal welds. The first pass on longitudinal welds shall accomplish at least 75 percent of the complete penetration. All inside longitudinal seams of steel pipe shall be ground smooth, after machine welding, a distance of 2 inches past the depth of the beveling shoes.

Joint welds shall be continuous for the full length of the seam, and shall be built up uniformly at the center of the weld to form a reinforcement on both sides of the plate. The bead on the outside of the pipe shall have a height of at least 1/16 inch and no more than 3/32 inch and a minimum width of at least one and one-half times the thickness of the plate; provided that in any case the weld and penetration shall be of sufficient width so that both edges to be joined shall be entirely involved in the weld, regardless of a possible

inaccuracy in the line of travel of the automatic electrode. Where the welding method permits a considerable deviation in the line of travel of the welding head, place a scribed line parallel to and at a fixed distance from the edges of the plates prior to welding so that the location of the welding bead with regard to the plate joints may be readily checked.

Where welding on small pipe is done from one side only, remove the bead on the inside of the pipe by chipping so that the finished weld on the inside of the pipe will be practically flush with the plates. The inside bead will in no case be required to be larger than the outside bead but shall be of sufficient size so that upon its removal, the inside fusion lines and any defects near the under surface of the weld metal will be exposed.

If complete penetration and reinforcement on both sides of butt-welded joints are not satisfactorily accomplished, when the welding is done from one side, then chip out the reverse side to the extent necessary to secure a clean surface of the originally deposited weld metal and make an automatic welding pass on the reverse side. The bead on the inside of the pipe shall be not more than 1/32 inch in height and the width of the bead shall be not less than 3/8 inch with smoothly tapered edges. Before making the second weld, chip out the underside of the first weld with a round-nosed tool until entirely solid and clean metal is reached.

Welding shall be subject to the requirement that there shall be no valley, groove, or undercut along the edge of or in the center of the weld, and that the deposited metal shall be fused smoothly and uniformly into the plate surface at the edges of the joint.

Each back-chipped welding groove shall be subject to inspection and approval prior to welding. All welding shall be subject to the requirement that there shall be no valley, groove, or undercut along the edge of, or in the center of the weld, and that the deposited metal shall be fused smoothly and uniformly into the plate surface at the edges of the joint.

If the normal welding process is interrupted for any reason, take special care when welding is resumed, to get full penetration and thorough fusion between the weld metal and the plates and the weld metal previously deposited. Where welding is interrupted by faulty machine operation, chip back the weld to where the presence of solid, clean metal indicates correct machine operation before resuming welding operations.

- d. Shop Circumferential Joints and Spiral Seam Joints: Shop circumferential and spiral seam joints greater than 1/2" shall be double butt welded. The details of shop circumferential and spiral seam joints shall conform to the requirements for longitudinal joints as given above. Circumferential joints in bends and welded fabricated fittings need not be made by automatic welding methods.

- e. Defects: Engineer shall inspect all defects prior to repair. Completely chip out porosity and cracks, trapped welding flux, or other defects in the welds in a manner which will permit proper and complete repair by welding. Repair defective welds by hand welding. Where the defect is so extensive as to make a hand repair undesirable, use automatic welds. If the percent of the weld defect exceeds 10 percent for longitudinal seams or 5 percent of spiral seams the pipe section shall be rejected and removed from the job rather than reworked.
- f. Equipment: In welding by an automatic process, both the rate of deposition of weld metal and the rate of travel of the electrode shall be automatically controlled. Use the submerged melt process for automatic welding.

C. Joints

- 1. When plate flanges are made from butt-welded segments, do not place the joints between segments adjacent to longitudinal joints in adjoining steel plate sections. Stress relieve flanges made from butt-welded segments.
- 2. Furnish forged steel slip-on flanges or welding neck flanges for companion flanges and connections. Blind flanges, reducing flanges, special flanges, and flanges which are greater in diameter than 24-inch-nominal pipe size may be made of plate.
- 3. For drilling of bolt holes of insulating flanges not dimensioned on the drawings, prepare flange bolting as recommended by the insulating sleeve manufacturer.

D. Shop Testing

- 1. General: After completion of fabrication and welding in the shop, and prior to the application of any lining or coating, test each component according to the following requirements.
- 2. Test Method Requirements - Shop
 - a. Test each section of steel pipe and each reducer in the shop at which it is manufactured by the hydrostatic test method. Each section of steel pipe or fabricated steel cylinder for cast-in-place sections that have joint rings attached after shop hydrostatic testing and are to be field welded shall have the longitudinal welds of the bell and spigot tested by a method acceptable to the Engineer.
 - b. Test each completed section of Fabricated Bend using the hydrostatic test method. If the Fabricated Bend is fabricated from steel pipe previously hydrotested, retest by hydrostatic test method or dye penetration test the circumferential weld seam. Except that sections requiring mitering on the ends may be tested before mitering. In the event the bell is formed subsequent to hydrostatic test, the Contractor shall perform a magnetic particle examination of that portion of each welded longitudinal joint which is within the longitudinal limits of the area of plate subjected to deformation in

forming the bell; provided, that a minimum of 10 percent of the longitudinal welds described above shall be examined by the radiographic method.

- c. Test each section of pipe with manholes and outlets attached after completion of the shop hydrostatic test specified in paragraph (D.2.a) as follows:
 - 1) For d/D greater than 0.35, where d is nominal diameter of the outlet and D is nominal diameter of main pipeline, test section by the dye penetration method plus soap and compressed air method at the collar.
 - 2) For d/D less than 0.35, test the collar by the soap and compressed air method.
- d. Assemble and retest flanged insulating joints by the hydrostatic test method. Test for electrical conductivity across joint.
- e. Perform tests of production welds in accordance with AWWA C200-86 for each heat of steel used. A guided-bend test specimen shall be considered as having passed only if no crack or other open defect exceeding 1/8 inch measured in any direction is present in the weld metal or heat affected zone of the base material after the bending. A tension test specimen shall be considered as having passed only if failure occurs in the base metal at a stress in excess of the minimum specified tensile strength. There shall be at least one set of welding tests as described in AWWA C200-86, Section 3.3.5 for each 1,000 lineal feet of spiral seam weld in addition to tests specified in Section 3.3.6 of the same standard.
- f. Test each slip-on type flange by the soap and compressed air method.
- g. Test backgouge and completed weld of all manual process groove welds by the liquid penetrant method. Test completed fillet welds by the liquid penetrant method.
- h. Manual process circumferential welds except at fabricated bends and all welds at collars and risers shall be subjected to 100 percent ultrasonic testing. 100 percent radiographic testing may be used in lieu of 100 percent ultrasonic testing.

3. Test Methods

- a. Shop Hydrostatic Test: Vent air from the pipe before the test pressure is applied. Hold the test pressure on each section for a sufficient length of time to permit inspection of all joints.
- b. Use the following hydrostatic test pressures for testing pipes without outlets:

$$P = \frac{1.6 \times f_y \times t}{1000}$$

D

where P = test pressure in psi.

f_y = yield stress of the steel used, in psi.

t = minimum thickness of the steel pipe section tested in inches

D = internal diameter of the steel pipe or cylinder, in inches.

- c. The hydrostatic test pressure for fabricated bends and pipes with outlets shall be the greater of field hydrostatic test pressure or 200 psi.
- d. When subjected to the above hydrostatic test pressure, the pipe shall show no leaks, distortion, or other defects. Repair any leaks or other defects which develop during the hydrostatic test by chipping out and rewelding, after which the repaired section shall again be tested until it shows no leaks or other defects.
- e. Test Bulkheads: Furnish and attach suitable dished heads and blind flanges for making the hydrostatic tests, and after completion of the tests, remove the heads and properly restore the ends of the sections.
- f. Radiographic Test: Make the radiographs in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels. Repair defects in the welds disclosed by the radiographs. Submit all radiographs and the notation of areas for repair to the Engineer for review.
- g. Ultrasonic Test: Make the ultrasonic tests in accordance with the requirements of the ASME Boiler Pressure Vessel Code, Section VIII, Pressure Vessels. Repair defects in the welds disclosed by ultrasonic testing. Prepare a report of the ultrasonic testing and submit to the Engineer for review.
- h. Soap and Compressed Air Test: Use compressed air at maximum 40-psi pressure into the joint, and while the joint is under pressure, swab every portion of every welded seam forming a part of the joint with a heavy soap solution or a commercial bubble-producing leak test fluid. Examine for leakage. Repair any defects disclosed by the test by chipping out, rewelding the chipped section, and retesting. Drill and tap the necessary test holes, and plug weld the holes after testing.
- i. Liquid Penetrant Test: Conform to the requirements specified in ASTM E 165. The materials used shall be either water washable or nonflammable. Products: "Spotcheck" by the Magnaflux Corporation or "Met-L-Check Flaw-Findr" by the Met-L-Check Company. Chip out all defects, reweld, and retest the section affected until it shows no leaks or other defects.

- j. Magnetic Particle Test: Magnetic particle test shall conform to the requirements specified in ASTM E 709, using the dry powder technique. Chip out all defects, reweld, and retest the section affected until it shows no leaks or other defects.

E. Curves, Angles, Closures, and Short Sections

1. Closures: Furnish closing courses and short sections of pipe to ensure the correct location of outlets, angles, and other pipeline features and to accommodate the pipeline installation, lining, and field testing programs. Closing courses and short sections of steel pipe shall be not less than 4 feet in length. Accurately form the inside diameter of butt-straps to match the largest outside diameter of the adjacent steel cylinders to which they are to join.
2. Deflections of Square-Ended Pipe: The angular deflection at any field joint in square-ended pipe shall not exceed a pull of 3/4 inch, and the penetration of the spigot into the bell at all points of the circumference shall be at least equal to the required penetration shown on the drawings. Do not use angular deflections at butt-strap joints.
3. Beveled Pipe: Use pipe sections having beveled bell ends for curves and angles in the alignment which cannot be accomplished using the maximum allowable deflection at square-ended pipe joints. Beveled pipe sections used in curved alignment shall be of standard length except when shorter sections are required to limit the radius of curvature in which case all sections shall be of equal length. Do not bevel spigot ends. The beveled end of a pipe shall not have a deflection from a plane perpendicular to the pipe axis exceeding 4 degrees.
4. Fabricated Bends: Do not use fabricated bends to accomplish angles in the alignment unless shown on the drawings or permitted by the Engineer. Deflection between the centerline of adjacent courses shall not exceed 15 degrees, and girth seams shall be double-butt welded in the shop.

The radius of curvature (R) for the axis of fabricated bends shall be 2.5 times the inside pipe diameter (D). The design shown on the drawings are based on such radius.

$$SI = \frac{R-0.167D}{R-0.5D}$$

F. Manholes, Outlets, and Pass Holes

1. Location: Manholes and outlets shall be vertical unless otherwise shown on the drawings.

Install at the stations shown for street-type installations, and install closures where required to conform to the designated locations. The manhole stations for right-of-way installations may be shifted a maximum of 6 feet provided that the outlet is located such that a minimum of four feet is maintained from the nearest end of the outlet encasement to the end of the pipe. If the outlet is not encased, maintain a minimum of four feet from the centerline of the outlet to the end of the pipe.

2. Pass Holes for Convenience

- a. The Contractor may provide, at his own expense, additional flanged outlets in the steel pipe for use in passing hose, lead wires, equipment, or materials into the pipe.
- b. The Contractor may also provide, at his own expense forged steel threaded outlets for use in passing hose or lead wires into the pipe. Tap the outlets for standard pipe thread, weld to the pipe, and close after use with solid forged steel plugs. The plugs shall not project beyond the inner surface of the pipe shell. Retap the pipe thread in the outlet to correct any distortion caused by welding. Apply a seal weld made by at least two passes around the inside or outside of the plug after it has been inserted in final position in the field.
- c. Coat outlets, plugs, and closures inside and outside to match the adjacent coated surfaces in the same manner as specified for outlets and as required at field joints in the pipe.

G. Pipeline Coatings

Apply the following types of coatings to the exterior of cement mortar lined steel pipe as shown on the construction plans:

1. Coat exposed pipe in vaults and structures in accordance with Section 09900, System No. 10.
2. Paint the exposed portion of joints, seep rings, and thrust rings with a 3-mil thickness of primer. Products: Koppers Bitumastic Jet-Set, McCloskey Varnish Co. Gilsonite V4007, Tnemec Series 10 epoxy, or equal.
3. Coat the interior metal surfaces of the blind flanges of manholes and outlets with System No. 7 per Section 09900.
4. Cement Mortar Coating: All cement mortar coating shall be applied in conformance with AWWA Standard C205. Cement for mortar coating shall be as specified in Part 2, Article C of this Section.

H. Mortar Linings

1. Apply to all pipe either shop- or field-applied mortar lining. Apply the following types of cement-mortar linings to the interior of the pipe in accordance with AWWA C205 or AWWA C602 as applicable, except as noted:
 - a. Pneumatically Applied Mortar Lining: Apply, with pneumatic equipment, a mortar lining to welded steel pipe sections that cannot accommodate the pipe lining machine.
 - b. Reinforced Mortar Lining: Tack weld wire mesh reinforcement to certain steel fittings as specified in paragraph H.4 or where shown on the drawings, then apply mortar.

- c. Spun Mortar Lining: Select and process materials and place the mortar while the pipe is spun in a centrifugal machine.
2. Pneumatically Applied Mortar Lining: Interior surfaces of welded steel, cast-in-place lined pipe, and steel fittings, which cannot accommodate the lining machine shall receive a pneumatically applied mortar lining with a steel-troweled finish. The materials and the proportions, mixing, sampling, and application shall conform to the description of field-placed mortar.

Pneumatically applied mortar lining in steel pipe and fittings shall have a thickness of 1/2 inch with a tolerance of plus 1/4 inch and minus 0, unless shown otherwise on the drawings. The thickness shall be tested 4 feet from the end of each length of pipe. A total of 6 gauge readings shall be taken at each location.

Apply the mortar lining in each pipe section or unit in a continuous operation without construction joints except that outlets and fittings of less than 36 inches in diameter may be lined with mortar by hand plastering.

Damage to the lining resulting from falling rebound, from improper screeding and troweling, or from other operations or negligence on the Contractor's part shall be cause for rejection.

3. Reinforcement in Mortar Linings: Reinforce mortar linings for installation on flat surfaces, at abrupt angular changes in surfaces, or where lining is 3/4 inch or greater in thickness except where reinforcement is specifically indicated to be omitted.

Place fabric inside the sections so that the members lengthwise of the strip extend circumferentially around the inside surface, and attach to the steel surface by electric-arc tack welding at intervals not more than 16 inches apart, measured both along the axis of the section and circumferentially-overlap sides and ends of the reinforcement one full mesh.

4. Application of Spun Mortar Lining: Unless otherwise shown on the drawings, the thickness of the lining in the pipe shall be 1/2 inch with a tolerance of plus 1/4 inch and minus zero. Manhole and outlet thimbles shall have a lining thickness of 3/8 inch with a tolerance of plus 1/8 inch and minus 0. The pipe shall be truly round prior to spinning. Regardless of the amount of out-of-roundness, if any section of pipe (when rotated in the spinning machine at the peripheral speed to be used for compaction) vibrates or exhibits any other departure from the smooth, concentric rotation necessary to produce a lining of the required quality, remove from the machine before the batch of mortar is deposited and to cylindrical shape so that when returned to the spinning machine the required smooth, concentric rotation will be obtained.

Immediately after application of the cement mortar lining, each pipe shall be tested for uniformity of lining thickness. Cement mortar thickness measurements shall be taken at both pipe ends and at the pipe invert, top and spring line (four measurements at three locations) with additional measurements taken as directed by the Engineer. If cement mortar lining does not meet the required thickness to the tolerances specified herein, lining shall be completely removed, the bare steel pipe prepared and relined to the tolerances specified herein or lined in the field. Pipes that are not measured at the locations specified, or when cement mortar lining sets up prior to measuring, shall be rejected and relined unless otherwise approved in writing by the Engineer. Pipe shall be consecutively lined at the plant in accordance

with the manufacturing plant cement mortar lining process, if the Engineer determines that the process is not providing satisfactory cement mortar lining at the plant, or inadequate protection is being provided during transportation and installation as required by the specifications, the Engineer may reject the entire manufacturing plant cement mortar lining process and require that pipe be cement mortar lined in the field.

5. Bends, Shorts, and Small Fittings: Line the interior surfaces of shop-fabricated bends and short sections 36 inches or more in diameter with pneumatically applied mortar. Steel fittings having a diameter of less than 36 inches shall be lined with mortar which may be applied by hand plastering, provided that the methods used produce a lining substantially equivalent in quality to pneumatically applied mortar.
6. Manholes and Outlets: Where openings in the pipe shell for manholes, outlets, or other purposes are required, remove a sufficient quantity of the spun mortar lining to accommodate the welding of steel work at the opening while the lining is in a sufficiently green condition to facilitate its separation from the steel plate surface. Cut the opening in the steel plate and then weld the manhole thimble and reinforcement collar or other steel work in place. At all times during these operations, the spun mortar lining shall be kept continuously moist. After completion of the welding and of the testing for leakage, remove all damaged lining, prepare the interior surfaces, place or restore the lining in the pipe by the pneumatic method, line the manhole or outlet thimble with mortar by hand plastering, and promptly resume the required water spray cure of the lining.
7. Protecting Lined Pipe: Immediately after the mortar lining has been completed, place internal bracing at the uncoated ends of the pipe to prevent the maximum and minimum diameter at any point from deviating 1 percent or the nominal diameter and leave in place until stulls or bracing are placed in the pipe as required by the specifications or shown on the drawings for installing steel pipe, except that braces may temporarily be removed when the pipe is placed in the coating machine and replaced immediately after removing the pipe from the coating machine. If required, add additional interior braces prior to the specified coating, but not until the lining has received the minimum cure. Where braces are placed on coated areas, provide sufficient bearing surface at the ends of the braces inside the pipe so no damage will be done to the mortar lining. After installation of the pipe, remove any damaged lining and replace it with new pneumatically applied mortar lining.

I. Blind Flanges

At outlets not indicated to be connected to valves or to other pipes and to complete the installed pipeline hydrostatic test, provide blind flanges with bolts, nuts, and gaskets. Thickness of blind flanges shall be at least equal to thickness of mating flange.

J. Product Marking

1. Mark the pipe number in four inch tall letters 3 feet from each end of the pipe section.
2. Punch mark the edge of all fittings and beveled pipe section plates at the field top.

K. Plant Storage

Finished pipe in storage awaiting delivery shall be supported on earth berms or cradles located directly under supporting stulls inside the pipe. Pipe ends and openings are to be

sealed with plastic bulkheads to prevent excessive drying of the lining. Intermittent water sprinkling of the coating will be required to prevent drying and control cracks.

L. Delivery

Deliver the pipe alongside the pipe laying access road over which the pipe trailer-tractors can travel under their own power. Place the pipe in the order in which it is to be installed as can be estimated from station stakes at approximately 100-foot intervals and secure it from rolling. Maintain air closure membranes in an airtight condition.

PART 4 - PAYMENT

Payment of the work in this section will be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15076

SECTION 15100
MANUAL VALVES

PART 1 - GENERAL

1.01 Description

- A. This section includes materials, testing, and installation of manually operated valves and check valves.

1.02 Related Work Specified Elsewhere

- A. Painting and Coating: 09900.
- B. Hydrostatic Testing of Pressure Pipelines: 15042.

1.03 Submittals

- A. Submit shop drawings in accordance with Section 01300 and the following.
- B. Submit manufacturer's catalog data and detail construction sheets showing all valve parts and describing material of construction by material and specification (such as AISI, ASTM, SAE, or CDA).
- C. Show valve dimensions including laying lengths. Show dimensions and orientation of valve operators, as installed on the valves.
- D. Show valve linings and coatings.

PART 2 - MATERIALS

2.01. General

- A. Valves shall be provided complete with operating hand-wheels, chain-wheels, extension stems, floor stands, worm gear operators, operating nuts, chains, and wrenches required for operation. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body or bonnet or shown on a permanently attached corrosion-resistant plate.

2.02. Valve Operators

- A. Operators for Exposed Valves Smaller Than 6-Inches: Lever or wrench or hand wheel operators having adjustable, open stop memory positions shall be provided for exposed valves smaller than 6-inches.
- B. Operators for Buried and Submerged Valves
 - 1. Direct acting 2-inch square AWWA operating nuts shall be provided for all buried and submerged valves.
 - 2. Watertight shaft seals and watertight valve and actuator cover gaskets shall be provided. Totally enclosed operators designed for buried or submerged service shall be provided.

C. Operators for Valves 6-Inches and Larger

1. Gear operators shall be provided on all butterfly, ball, and plug valves 6-inches and larger. Gear operators for valves 8-inches through 30-inches shall be of the “worm gear” or of the “traveling nut” type. Gear operators for valves 36-inches and larger shall be of the worm gear type.
2. Gear operators shall be enclosed, suitable for running in grease with seals provided on shafts to prevent entry of dirt and water into the operator. Buried service valves shall be 90% grease packed by AWWA Standards. Gear operators for valves located above ground or in vaults and structures shall have handwheels. Minimum handwheel diameter shall be 12-inches.
3. Gear operators shall be of the totally enclosed design, proportioned to permit operation of the valve under full operating head in either direction, with a maximum pull of 80 pounds on the handwheel or crank. Operators shall be provided with open and closed position stop limiting devices. Operators shall be of the self-locking type to prevent the valve disc or plug from creeping. Operator components shall be designed to withstand a pull of 200 pounds for handwheel or chainwheel operators between the input and stop limiting devices without damage, and an input torque of 300 foot-pounds for worm gears and 450 foot-pounds for traveling nuts when operating against the stops.
4. Self-locking worm gears shall be a one-piece design of gear bronze material (ASTM B 427), accurately machine cut. The worm shall be hardened alloy steel (ASTM A 322, Grade G 41500; or ASTM A 148, Grade 105-85), with thread ground and polished. The reduction gearing shall run in a proper lubricant inside a ductile iron housing. Operators shall be AWWA proof of design compliant and shall be Limitorque Model PT Series, EIM Model WO or WG, or for contracts between Owner and Contractor, approved equal.
5. Gear operators shall be able to rotate the valve element (disc, plug, or ball) from the fully closed position to fully open position in a number of turns of the operator not fewer than thirty (30) turns and not more than three (3) times the number of diameter inches. Where the number of turns may fall outside of the range for turn limits above, the use of a factory attached spur gear reducer shall be used to provide the appropriate number of rotations from the fully “open” to the fully “closed” position. Spur gear assemblies shall be mounted integrally to the actuator by approved means and shall meet all of the other component and torque requirements listed herein.

D. Operating Torque Requirement for Buried Valves: Operators on buried valves shall be designed to produce the required torque on the operating nut with a maximum input of 150-foot-pounds.

E. Opening Direction: Valve operators, handwheels, or levers shall open by turning counterclockwise.

F. Position Indicators: Valve position indicators shall be provided for all above ground valves.

2.03. Valve Boxes for Buried Valves

A. General: Valve wells shall be 8-inch Schedule 40 PVC pipe, or 8-inch SDR 35 PVC pipe.

B. Valve Box Caps: Valve box caps shall be cast-iron, and shall be designed to rest without a frame on a cast-in-place concrete ring surrounding the valve extension pipe. The cap skirt shall be tapered for a close fit inside the upper sleeve portion of the valve box. The cap skirt shall be 6-inches deep. Minimum weight of nominal 10-inch cap shall be 40 pounds. Caps for potable water valve boxes shall be circular with the word SAWCo cast on the cap.

- C. Manufacturers: Valve boxes for potable water lines shall be Eisel Enterprises Inc. 10 Series, or for contracts between Owner and Contractor, approved equal.

2.04. Extension Stems for Buried Valve Operators

- A. Where the depth of the valve is such that its operating nut is more than 4-feet below grade, operating extension stems shall be provided to bring the operating nut to a point 12-inches below the surface of the ground and/or box cover. Extension stems shall be steel, and shall be complete with 2-inch-square operating nut. Stem shall be provided with a 1/8-inch centerguide to keep stem centered. Pinned couplings are not permitted. Extension stems shall conform to Standard Drawing W-9.

2.05. Bolts, Nuts, and Gaskets for Flanged Valves

- A. Bolts and nuts for flanged valves shall be described in the detailed individual piping specifications.

2.06. Painting and Coating

- A. Above Ground Valves or Valves in Vaults: Metal valves (except bronze and stainless-steel valves) located above ground or in vaults and structures shall be coated in accordance with Section 09900, System No. C-1. The specified prime coat shall be applied at the place of manufacture. Intermediate and finish coats shall be applied in field. Finish coat shall match the color of the adjacent piping. Handwheels shall receive the same coating as the valves.
- B. Buried Valves: Buried metal valves and extension stems shall be coated at the place of manufacture per Section 09900, Painting and Coating System No. D-1.
- C. Interior Coating: Metal valves 4-inches and larger shall be coated on the interior metal parts, excluding seating areas and bronze and stainless-steel pieces, per Section 09900, Painting and Coating, System No. G-1. Coating shall be factory applied by the valve manufacturer.

2.07. Valves

- A. Above Ground Gate Valves 3-Inches and Smaller: Above ground gate valves, 1/4-inch through 3-inches, for water service shall be non-rising stem, screwed bonnet, solid wedge disc type designed for a minimum working pressure of 220 psi. Valves shall have threaded ends. Materials of construction shall be as follows:

Component	Material	Specification
Body, bonnet, disc	Bronze	ASTM B62
Stem	Bronze or copper silicon	ASTM B62, B99 (Alloy 651), B584 (Alloy C87600), B371 (Alloy 694)

Stem material shall have a minimum tensile strength of 60,000 psi and a minimum yield strength of 30,000 psi. Handwheels shall be brass. Packing shall be Teflon asbestos. Valves shall be Crane 438, Stockham 103, or approved equal.

- B. Buried Gate Valves Smaller Than 3-Inches: Buried gate valves for air or water service shall be non-rising stem type, double disc, parallel seat, and shall be designed for a minimum working pressure of 200 psi. Valves shall have flanged, PVC, or threaded ends as required for the type of pipe used. Materials of construction shall be as follows:

Component	Material	Specification
Body, bonnet, operating nut, stuffing box	Cast iron	ASTM A126, Class B
Bonnet bolts stuffing box bolts	Steel, cadmium plated	ASTM A307, Grade B; B766, Class 25, Type II
Discs, disc nut, disc ring, seat ring	Bronze	ASTM B62
O-ring	Synthetic rubber	ASTM D2000
Stem	Copper silicon or manganese bronze	Copper silicon or ASTM B584, Alloys C86200, C86300, C86400, C87500, or C87600

Valves shall be Stockham G-736, G-739, or G-745; Kennedy Figure 597X or 561X; Mueller Series A2380; or approved equal.

- C. Resilient Seated Gate Valves, 3-Inches Through 12-Inches: Resilient seated wedge-type, gate valves shall conform to AWWA C509 and the following requirements. Valve shall have a wedge-type resilient seat, fully encapsulated in peroxide-cured EPDM. Valves shall be designed for a minimum working pressure of 200 psi, and shall not leak at that pressure. Valves shall have non-rising stems. Stem nuts shall be independent of the gate and shall be made of solid bronze. All internal working parts, including the stem, shall be all bronze containing not more than 2 percent aluminum or more than 7 percent zinc. Bronze shall be ASTM B62 (85-5-5-5) bronze, except that stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of 10 percent elongation in 2-inches. Materials of construction shall be as follows:

Component	Material	Specification
Body operating nut, bonnet, seal plate	Cast iron	ASTM A126, Class B
Gate	Cast iron Ductile iron	ASTM A126, Class B ASTM A536, Grade 65-45-12
Bonnet and seal plate nuts and bolts	Stainless-steel	ASTM A276, Type 316
O-rings	Synthetic-rubber	ASTM D2000

Low friction, torque reduction thrust bearings shall be provided both above and below the stem collar. Stuffing boxes shall be O-ring seal type with two rings located in stem above thrust collar. Each valve shall have a smooth unobstructed waterway free from any sediment pockets. Gates shall be of the wedge-type, encapsulated in peroxide-cured EPDM rubber. Valves shall be Clow RW, Mueller A2360, M&H Style 4067, or approved equal.

- D. Butterfly Valves 4-Inches and Larger, Class 150B: Butterfly valves shall be short body, flanged type, conforming to AWWA C504, Class 150B. Wafer style valves are not permitted. Unless otherwise noted, minimum working differential pressure across the valve disc shall be 150 psi. Valve ends shall be as shown on the drawings; flanged ends shall be Class 125, ANSI B16.1. Valve shafts shall be Type 304 or 316 stainless-steel. Valve shafts shall be stub shaft or one-piece units extending completely through the valve disc. Valve bodies shall be tested at a pressure equal to twice the design working pressure. Gears shall be sized for bi-directional flow at 16 fps and at full rated pressure and differential. Materials of construction shall be as follows:

Component	Material	Specification
Body	Cast iron or ductile iron	ASTM A48, Class 40; ASTM A126, Class B; or ASTM A536, Grade 65-45-12
Exposed body capscrews, and bolts and nuts	Stainless-steel	ASTM A276, Type 304 or 316
Discs	Cast iron, ductile iron, or Ni-Resist	ASTM A48, Class 40; ASTM A536, Grade 65-45-12; or ASTM A436, Type 1

The rubber seat shall be an integral part of the valve body. Rubber seats fastened to the disc by any means shall not be allowed. Valves shall be M&H, Clow, Mueller Lineseal, or approved equal.

- E. Ball Valves 2-Inches and Smaller: Ball valves, 2-inches and smaller, for water service shall be stainless steel, and shall be rated at a pressure of 300 psi WOG at a temperature of 150°F. Valves shall have plastic coated lever operators. Valves shall have full bore ports, screwed ends, and non-blowout stems. Materials of construction shall be as follows:

Component	Material	Specification
Body, ball, stem	Stainless-steel	Type 316, ASTM A276
Seat, seals	Teflon	

Valves shall be Stockham Figure S-127 or approved equal.

- F. Ball Valves 2-1/2-Inches to 6-Inches: Ball valves 2-1/2-inches to 6-inches shall be rated for a minimum working pressure of 150 psi. Valves shall have flanged ends. Materials of construction shall be as follows:

Component	Material	Specification
Body, ball	Ductile iron	ASTM A395, ASTM A445
Stem	Carbon steel	ASTM A216, Grade WCB
Seat, seals	Teflon	

Valves shall be Jamesbury Style 150F, Powell Figure 4222T, or approved equal.

- G. Eccentric Plug Valves, 4-Inches Through 12-Inches: Eccentric plug valves, 4-inches through 12-inches shall be of the non-lubricated type with external adjustable packing. Minimum pressure rating shall be 175 psi. Unless noted otherwise on the drawings, ends shall be flanged, Class 125 per ANSI B16.1. Materials of construction shall be as follows:

Component	Material	Specification
Body	Cast iron	ASTM A126, Class B
Plug	Cast iron, ductile iron, Ni-Resist	ASTM A126, Class B ASTM A536, Grade 65-45-12, ASTM A436

Plugs shall be cylindrical with neoprene, Buna N or EPDM facing to provide drip-tight shutoff. Elastomer choice shall be dependent on project conditions. Valve body seats shall have a raised welded-in overlay of not less than 90 percent nickel. Packing shall be replaceable with valve body under full pressure and with valve in the fully open position. Shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable. Plug shall be of the one piece design. Proof of design shall accompany

submittals and leak tests shall accompany shipment. The stems shall come equipped with grit extruders. Valves shall be DeZurik PEC, Clow Model F5412 or approved equal.

- H. Swing Check Valves: Swing check valves shall conform to AWWA C508, and shall be iron body, bronze mounted with the following materials of construction:

Component	Material	Specification
Disc or clapper, seat ring, valve body seat ring	Bronze or brass	ASTM B62, B16, or B584 (allows C84400 or C87600)
Body and cap	Cast iron	ASTM A126, Class B
Disc and hinge or arm	Cast iron or bronze	ASTM A126, Class B ASTM B62
Hinge pin	Stainless-steel	AISI Type 316
Cover bolts and nuts	Stainless-steel	ASTM A193, Grade B8M; ASTM A194, Grade 8M

Ends shall be flanged, Class 125, ANSI B16.1. Valves shall be designed for a minimum working pressure of 150 psi. Valve shall be equipped with outside lever and spring. Valves shall be fusion bonded epoxy lined and coated. Valves shall be Clow f-5340, M&H Style 259, Crispin SWL, Milliken BBW or approved equal.

- I. Silent Check Valves, Class 150: Silent check valves shall be designed to be installed between the flanges of the adjoining pipe. Valves shall be equipped with a spring mechanism to provide for nonslam closure of the valve without backflow, in any position, and shall not be dependent on gravity or backflow for closure. Materials of construction shall be as follows.

Component	Material	Specification
Body	Cast iron or ductile iron	ASTM A 126, Class B; or ASTM A 536, Grade 65-45-12
Plug and seat	Bronze	ASTM B 584
Spring, pin, stops	Stainless-steel	AISI Type 316
Sealing element	Buna-N	

Valves shall be APCO Series 600, Crispin WC, Milliken or approved equal.

- J. Solenoid Valves 1-1/2-Inches and Smaller: Solenoid valves of sizes 1/4-inch through 1-1/2-inches for water and air service shall have forged brass (Alloy C23000) or bronze (ASTM B 62) bodies with Teflon main seats. Internal plunger, core tube, plunger spring, and cage assembly shall be stainless steel (Types 302, 304, or 305). Solenoid enclosures shall be NEMA Type IV. Valve actuators shall be 120-volt AC. Seals shall be Teflon. Valves shall have a maximum operating pressure and a maximum differential pressure of 250 psi. Solenoid valves shall be energized to open or close, as required. Valves shall be ASCO "Red Hat," only.
- K. Tapping Valves: Tapping valves shall conform with the requirements for resilient seat gate valves 3-inches and larger. Valve ends shall be flanged. Valves shall be Clow RW, Mueller A2360, American AVK, American Flow Control AFC500, and M&H Style 4067, or approved equal. See Standard Drawing W-6.
- L. Tapping Sleeves: Tapping sleeves shall be either the "mechanical joint" type or stainless steel full-circle style sleeves. Gaskets shall be EPDM rubber with a wide cross-section. Bolts, nuts, and washers shall be Type 316 stainless steel. Mechanical joint tapping sleeves shall be JCM Industries, Inc. JCM 414, Mueller H-615 or approved equal. Stainless steel full-circle tapping sleeves shall be JCM Industries, Inc. JCM 432, Mueller H-304SS, Romac SST111 or for contracts between Owner and Contractor, approved equal. See Standard Drawing W-6.

- M. Detector Check Valves: Detector check valves shall have flanged ends conforming to ANSI B16.1, Class 125. Valves shall be pressure tested to twice design working pressure. Valve casing shall be hot-dipped galvanized and body shall be tapped to accept by-pass meter piping. Materials of construction shall be as follows:

Component	Material	Specification
Body, bonnet	Cast iron	ASTM B126, Class B
Bonnet bolts	Stainless-steel	ASTM A276, Type 304
Hinge pin (shaft)	Stainless-steel	ASTM A276, Type 304 or 316
Clapper	Bronze	ASTM B62
Clapper seat ring	Bronze (tinned)	ASTM B62
Clapper seal	Rubber	
Weight	Lead	

The mainline valve shall automatically open, permitting unrestricted flow, when the pressure loss through the by-pass meter is approximately 1.5 psi. Valves shall be Hersey EDC II, Grinnel, Mueller A-2133-6, or approved equal.

- N. Needle Valves: Needle valves shall be stainless steel bodied with stainless steel trim. Valve shall be Hoke Series 2200 or Engineer approved equal.
- O. Pressure Relief Valves: Pressure relief valves shall be stainless steel bodied, stainless steel fitted with Teflon seals. Pressure relief valves shall be Circle Seal Series 5100 or Engineer approved equal.
- P. Y-Type Strainers: Y-Type strainers shall be stainless steel bodied with Type 316 stainless steel strainer. Strainer shall be 1/32-inch diameter perforations. Y-Type strainers shall be Yarway, Baily, or Engineer approved equal.
- Q. Air Vacuum and Release Valves: Valves shall be manufactured in accordance with AWWA C-512.
1. Combination air-release valves for water service shall consist of both an air and vacuum valve and air-release functions contained in one body. The air and vacuum shall serve to release and admit large quantities of air when pipelines are filled and drained. The air-release shall serve to release small quantities of air that accumulate during pipeline operation.
 2. Valves shall have an operating pressure of 300 psi. Valves shall be APCO 140C/150C Series; Val-Matic 200C Series, Crispin UL Series or approved equal.
 3. Materials of construction for combination air-release valves shall be as follows:

Component	Material	Specification
Body and cover	Cast iron	ASTM A 126, Class B
Float, float arm, poppet	Stainless-steel	AISI Type 316, ASTM A 240 or A 276
Seat, orifice button	Buna-N	

PART 3 - EXECUTION

3.01. Joints

- A. Flanged Joints: Boltholes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Flanges shall be cleaned by wire brushing before installing flanged valves. Flange bolts and nuts shall be cleaned by wire brushing, threads shall be lubricated with oil and graphite, and nuts shall be tightened uniformly and progressively. If flanges leak under pressure testing, nuts and bolts shall be loosened or removed, the gasket shall be resealed or replaced, the bolts and nuts shall be reinstalled or re-tightened, and the joint retested. Joints shall be watertight.
- B. Threaded Joints: Threaded joints shall be cleaned by wire brushing or swabbing. Teflon joint compound or Teflon tape shall be applied to pipe threads before installing threaded valves. Joints shall be watertight.

3.02. Valve Installation

- A. Valves in Horizontal Piping: Unless otherwise indicated on the drawings, valves in horizontal runs of pipe having centerline elevations 4'-6", or less, above the floor, shall be installed with their operating stems vertical. Valves in horizontal runs of pipe having centerline elevations between 4'-6" and 6'-9" above the floor shall be installed with their operating stems horizontal.
- B. Valves in Vertical Piping: Valves on vertical runs of pipe that are next to walls shall be installed with their stems horizontal, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their stems horizontal, oriented to facilitate valve operation.
- C. Buried Valves: Buried valves shall be wrapped with two layers of 8-mil polyethylene wrap per AWWA C105.
- D. Valve Supports: Valves shall be anchored in concrete as shown on Standard Drawing W-8 or on the valve detail drawings. Concrete supports are not required for valves bolted to flanged pipe or fittings.
- E. Backfill: Backfill within 24-inches of valves shall be clean washed sand in accordance with the requirements of Section 02223, Trenching, Backfilling, and Compacting.

3.03. Valve Boxes

- A. Valve boxes shall be firmly supported and shall be kept centered and plumb over the operating nut of the valve. Beveled sections of pipe will not be allowed at the top of the valve extension pipe. The top cut shall be square and machine made. In new tracts, and where pavement has not been placed, the valve extension risers for "key valves" shall extend well above the ground level to permit ease of location in case of emergency shutoffs. The final valve box elevation shall be flush with the finished pavement surface, or at the level shown on Standard Drawing W-8.

3.04. Tapping Sleeves

- A. Tapping sleeves shall be installed in accordance with the manufacturer's instructions. The pipe barrel shall be thoroughly cleaned with a wire brush to provide a smooth, hard surface for the sleeve. The sleeve shall be supported independent of the pipe during the tapping operation. The sleeve shall be pressure tested in the presence of the Owner Representative prior to tapping. The stainless steel bolts on the tapping sleeve shall be tightened with 85 to 125 foot-pounds of torque, and retightened after tap is completed. Thrust blocks shall be provided at the tapping sleeve.

3.05. Valve Leakage Testing

- A. Valves shall be tested for leakage at the same time that the connecting pipelines are tested. See Section 15042, Hydrostatic Testing of Pressure Pipelines, for pressure testing requirements.

PART 4 – PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15100

**SECTION 15102
RESILIENT WEDGE GATE VALVES**

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation of resilient wedge gate valves, 4-inches and diameter and larger.

B. Contractor Submittals

The Contractor shall submit shop drawings for all valves supplied under this section for review by the Owner in accordance with Section 01300.

C. Reference Standards

Valves shall conform, as applicable, with the latest editions of the following codes and standards:

AWWA C509	Resilient Seated Gate Valves
ASTM B62	Composition Brass or Ounce Metal Castings
ASTM A125 Class B	Gray Iron Castings for Valves
ANSI B16.1	Cast Iron Pipe Flanges
ASTM D 429	Tests for Rubber Property Adhesion to Rigid Substrates

D. Approved Manufacturers

1. Valves

- a. M & H
- b. Mueller
- c. U.S. Pipe

2. Valve Boxes

- a. Brooks Products No. 4TT

PART 2 - MATERIALS

A. General

- 1. Valves shall be installed complete with operating hand wheels, extension stems, operating nuts, and wrenches required for operation.
- 2. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body or bonnet or shown on a permanently attached plate.
- 3. Each valve body shall be tested under a test pressure equal to twice its design water working pressure.

B. Valve Operators

Provide 2-inch AWWA operating nuts for buried and submerged valves.

C. Construction

1. Resilient seated gate valves shall conform to ANSI/AWWA C509 and shall have cast iron bodies with flanged ends, rubber-coated cast iron gate, flanged bonnet, bronze stem, O-ring seals, and operating nut.
2. All valves shall be bubble tight at 200 psi working pressure.
3. Flange drilling shall be in accordance with ANSI B16.1 for cast-iron flanges.
4. Valves shall have nonrising low zinc stems, opening by turning left and provided with 2-inch square operating nut.
5. Each valve shall have a smooth unobstructed waterway free from any sediment pockets.
6. Stuffing boxes shall be O-ring seal type with two rings located in stem.
7. Low-friction torque-reduction thrust bearings shall be located both above and below the stem collar.
8. Materials of construction shall be as follows:

<u>Component</u>	<u>Material</u>	<u>Specification</u>
Body, operating nut Bonnet, Seal	Cast Iron	ASTM A126 - Class B
Gate	Cast Iron Ductile Iron	ASTM A126 - Class B ASTM A536 Grade 65-45-12
Bonnet and Seal Nuts and bolts	Stainless	ASTM A276 Type 316
O-Rings	Synthetic Rubber	ASTM D2000

9. All internal working parts (excluding gate) shall be all bronze containing not more than 2 percent aluminum or more than 7 percent zinc. Valve stems shall be cast or forged from bronze having a tensile strength of not less than 60,000 psi, a yield point of not less than 30,000 psi, and an elongation of not less than 10 percent in 2 inches.
10. All gates shall be encapsulated in Buna-S rubber or nitrile elastomer.

D. Painting and Coating

1. Coat the exterior of metal valves located aboveground or in vaults and structures in accordance with Section 09900. Apply the specified prime coat at the place of manufacture. Apply finish coat in the field. Finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.
2. Coat buried metal valves at the place of manufacture. Provide manufacturers standard epoxy coating.
3. Valves 4 inches and larger shall be coated on their interior metal surfaces excluding seating areas and bronze and stainless steel pieces. Sandblast surfaces in accordance with SSPC SP-5. Removal all protuberances which may produce pinholes in the lining. Round all sharp edges to be coated. Remove any contaminants which may prevent ponding on the lining.
4. Apply powdered thermosetting epoxy (Scotchkote 134 or equal) per the manufacturer's application recommendations to a thickness of 16 mils
5. All thermosetting epoxy coatings shall be applied by the valve manufacturer.

E. Valve End Connections

Valve end connections shall be flanged.

F. Bolts and Nuts for Flanged Gate Valves

Bolts and nuts for flanged gate valves including valve bonnet bolts shall be stainless steel in accordance with Section 15051.

G. Gaskets

Gaskets for flanged end valves shall be as described in Section 15051.

PART 3 - EXECUTION

A. Installation

1. General

All gate valves shall be installed in accordance with AWWA Standards and the Supplier's printed recommendations.

2. Joints

Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

B. Valve Leakage Testing

1. Test valves for leakage at the same time that the connecting pipelines are tested. See Section 15042 for pressure testing requirements.

2. Protect or isolate any valves whose pressure rating is less than the test pressure.

C. Exterior Protection

1. All exposed flanges and other metal surfaces and all damaged coatings shall be coated after assembly with bituminous mastic per Section 09900.

2. Wrap buried valves with 8-mil polyethylene wrap per AWWA C105.

D. Valve Boxes

1. Valve boxes shall be firmly supported and shall be kept centered and plumb over the operating nut of the valve.

2. Beveled sections of pipe will not be allowed at the top of the valve extension pipe. The top cut shall be square and machine made.

3. Valve extension pipe material shall be 8-inch Class 150 PVC pipe unless otherwise shown on the drawings.

4. Design cast iron cap to rest within a frame on a cast-in-place concrete ring surrounding the valve extension pipe; size and tapered skirt of the cap for a close fit inside the upper sleeve portion of the valve box. Caps for the domestic water system shall be triangular with the word "WATER" cast on the cap. Coat the cap with frame and asphalt or coal-tar paint. Use Brooks Products 4TT valve box for valve stack risers.

5. The box cover shall be flush with the surface of the finished pavement or at any other level designated by the Owner's Representative.

E. Backfill

1. All backfill within 24 inches of a valve shall be clean, washed sand.

2. Backfill is to be placed and compacted in accordance with Section 02223.

F. Valve Leakage Testing

1. Test valves for leakage at the same time that the connecting pipelines are tested. See Section 15042 for pressure testing requirements.

2. Protect or isolate any valve whose pressure rating is less than the test pressure.

PART 4 - PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15102

**SECTION 15104
AIR RELEASE AND COMBINATION AIR
AND VACUUM RELEASE VALVES**

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation of air release and combination air and vacuum release valves.

B. Contractor Submittals

1. Submit shop drawings in accordance with Section 01300.
2. Submit manufacturer's catalog data. Show dimensions, materials of construction by ASTM reference and grade and coatings.

Approved Manufacturers

1. APCO (Valve and Primer Corporation)
2. Crispin (Multiplex Manufacturing Co.)
3. Valmatic (Valve and Manufacturing Corporation)

PART 2 - MATERIALS

A. General

1. Air release valves shall vent accumulating air while system is in service and under pressure and be of the size shown on the plans. They shall be designed for a minimum water working pressure of 150 psi, unless otherwise shown.
2. Combination air and vacuum release valves shall be installed as shown on the plans. They shall be designed for a minimum water working pressure of 150 psi, unless otherwise shown.
3. If pipeline profiles change during construction from that shown on the drawings, the combination air and vacuum release valves shall be installed at the high points in lines as constructed.
4. Combination air valves shall allow large volumes of air to escape out a large orifice when filling a pipeline and allow large quantities of air to enter the pipeline as it is drained. The large valve shall close when liquid enters the valve. During large orifice closure, a small air release orifice shall open to allow small pockets of air to escape automatically and independently of the large orifice.

B. Construction

1. All materials of construction shall be certified in writing to conform to ASTM

specifications as follows:

Body & Cover	Cast Iron	ASTM A126
Float	Stainless Steel	ASTM A240
Needle	Buna N	Nitrile Rubber
Internal Linkage	Stainless Steel	ASTM A296
Plug	Bronze	ASTM D2133 or ASTM A126 Grade

2. Coat exterior of valves with one coat of primer and two coats of finish paint (field applied) in accordance with Section 09900, System No. 10. Apply prime coat at the place of manufacture.

C. Steel Vented Pipe Vertical Cover

The steel vented pipe vertical cover shall be CEBE-21 or approved equal.

D. Service Piping

Water service piping utilized in the installation of the combination air and vacuum relief valve shall be Type K copper with bronze accessories per Section 15057.

E. Air Release Valves

The air release valves shall be built for 150 psi service, and shall be APCO Model No. 144 DAT.1, or Engineer approved equal.

PART 3 - EXECUTION

A. Installation

1. All valves shall be installed in accordance with the manufacturer's printed instructions.
2. The tap for the combination air and vacuum release valves shall be made in a level section of pipe no closer than 18 inches to a bell, coupling, joint, or fitting.
3. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
4. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.
5. The combination air and vacuum relief valves and the steel vented pipe cover shall be painted in accordance with Section 09900. The final coat of paint shall be applied immediately prior to the final inspection.

B. Valve Pressure Testing

1. Test valves at the same time that the connection pressure pipelines are pressure tested. See Section 15042 for pressure testing requirements.
2. Protect or isolate any parts whose pressure rating is less than the test pressure.

PART 4 - PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15104

**SECTION 15106
BUTTERFLY VALVES**

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation of butterfly valves.

B. Contractor Submittals

The Contractor shall submit shop drawings for all valves supplied under this section for review by the Owner in accordance with Section 01300.

C. Reference Standards

Valves shall conform, as applicable, with the latest editions of the following codes and standards.

AWWA C504	Rubber-Seated Butterfly Valves
ASTM B62	Composition Brass or Ounce Metal Castings
ASTM A125 Class B	Gray Iron Castings for Valves
ANSI B16.1	Cast Iron Pipe Flanges
ASTM D 429	Tests for Rubber Property Adhesion to Rigid Substrates

D. Approved Manufacturers

1. Valves
 - a. M & H
 - b. Mueller
 - c. Engineer approved equal
2. Valve Boxes
 - a. Brooks Products No. 4 TT
 - b. Engineer approved equal

PART 2 - MATERIALS

A. General

1. Valves shall be installed complete with operating handwheels or manual operators, and operating nuts, as shown on the plans, and as required for operation.

2. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body or shown on a permanently attached plate.
3. Butterfly valves shall be short body, conforming to AWWA C504, Class 150B. Minimum working differential pressure across the valve disc shall be 150 psi unless specified otherwise on the drawing.
4. Butterfly valves shall be furnished and installed with flanged ends as shown on the plans and as herein specified. Wafer style valves will not be permitted.
5. Each valve body shall be tested under a test pressure equal to twice its design water working pressure.
6. Valves shall be bubble tight at rated pressures and shall be suitable for throttling service and frequent operation after long periods of inactivity. Valve discs shall rotate 90 degrees from the full-open position to the tight-shut position.

B. Construction

1. Valve shafts shall be Type 304 or 316 stainless steel or carbon steel with Type 304 or 316 stainless steel journals and static seals. Valve shafts shall be dual stub shafts or a one-piece shaft extending completely through the valve disc.
2. Materials of construction shall be as follows:

<u>Component</u>	<u>Materials</u>	<u>Specification</u>
Body	Cast Iron or Ductile Iron	ASTM A48 Class 40; ASTM A126, Class B
Exposed Body Capscrews, and Bolts and Nuts	Stainless Steel	ASTM A276 Type 304 or 316
Discs	Cast Iron or Ductile Iron	ASTM A48, Class 40; ASTM A 126

3. Flanged ends shall be Class 125, ANSI B16.1.
4. Bolts
 - a. Bolts and nuts for flanged butterfly valves shall be stainless steel in accordance with Section 15051.
 - b. Gaskets for flanged butterfly valves shall be as described in Section 15051.

C. Valve Operators

1. Provide traveling nut or worm gear operators on butterfly valves.
2. Provide 2-inch AWWA operating nuts for buried valves. Provide valve extension per plans whenever valve nut is 4 feet or more in depth as measured from finished grade to top of nut.
3. Provide totally enclosed operators designed for buried service.
4. Traveling nut or worm gear operators shall be enclosed, suitable for running in oil with seals provided on shafts to prevent entry of dirt and water into the operator. Operators for valves located in vaults and structures shall have handwheels. Minimum handwheel diameter shall be 12 inches. The operator shall contain a dial indicating the position of the valve disc or plug.
5. Traveling nut and worm gear operators shall be of the totally enclosed design so proportioned as to permit operation of the valve under full operating head with a maximum pull of 80 pounds on the handwheel or crank. Provide stop limiting devices in the operators in the open and closed positions. Operators shall be of the self-locking type to prevent the disc or plug from creeping. Design operator components between the input and the stop-limiting devices to withstand without damage a pull of 200 pounds for handwheel operators and an input torque of 300 foot-pounds for operating nuts when operating against the stops.
6. Operators on buried valves shall produce the required torque on the operating nut with a maximum input of 150 foot-pounds. All buried valves shall have a valve can and cast iron cover.
7. Valve operators and handwheels shall open by turning counterclockwise.

D. Painting and Coating

1. The valves shall be delivered to the Contractor without the specified coatings. The Contractor shall then deliver the valves to a shop specializing in applying the specified coatings to butterfly valves. The Contractor shall then deliver the valves to the jobsite and shall install the valves. One shop specializing in the application of the specified coatings is Charles Anderson at (909) 780-3320.
2. Coat the metal valves at the specialty shop per Section 09900.
3. Exterior of buried valves shall be coated with System No. 21 coal tar epoxy.
4. Exterior of above ground valves shall be coated with System No. 10, high build epoxy.
5. Interior of all valves shall be coated with System No. 7, epoxy.
6. Surface preparation shall be per Section 09900

PART 3 - EXECUTION

A. Installation

1. General

All butterfly valves shall be installed in accordance with AWWA Standards and the supplier's printed recommendations.

2. Joints

Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

B. Valve Testing

1. Test valves for leakage at the same time that the connecting pipelines are tested. See Section 15042 for pressure testing requirements.
2. Protect or isolate any valves whose pressure rating is less than the test pressure.

C. Exterior Protection

1. All exposed flanges and other metal surfaces and all damaged coatings shall be coated after assembly with bituminous mastic per Section 09900.
2. Wrap buried valves with 8-mil polyethylene wrap per AWWA C105.

D. Valve Boxes

1. Valve boxes shall be firmly supported and shall be kept centered and plumb over the operating nut of the valve.
2. Beveled sections of pipe will not be allowed at the top of the valve extension pipe. The top cut shall be square and machine made.
3. Valve extension pipe material shall be 8-inch Class 150 PVC pipe unless otherwise shown on the drawings.
4. Design cast iron cap to rest within a frame on a cast-in-place concrete ring surrounding the valve extension pipe; size and tapered skirt of the cap for a close fit inside the upper sleeve portion of the valve box. Caps for the domestic water system shall be triangular with the word "WATER" cast on the cap. Coat the cap with frame and asphalt or coal-tar paint.

5. The box cover shall be flush with the surface of the finished pavement or at any other level designated by the Owner's Representative.

E. Backfill

1. All backfill within 24 inches of a valve shall be clean, washed sand.
2. Backfill is to be placed and compacted in accordance with Section 02223.

F. Valve Leakage Testing

1. Test valves for leakage at the same time that the connecting pipelines are tested. See Section 15042 for pressure testing requirements.
2. Protect or isolate any valve whose pressure rating is less than the test pressure.

PART 4 - PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15106

SECTION 15122 PIPE COUPLINGS

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation of flexible pipe couplings and flanged coupling adapters.

B. Contractor Submittals

The Contractor shall submit shop drawings for all pipe couplings supplied under this section for review by the Owner in accordance with Section 01300.

C. Reference Standards

ASI B16.1 Cast Iron Pipe Flanges

ANSI B16.5 Pipe Flanges and Flanged Fittings Steel Nickel Alloy and Other
Special Alloys

ASTM D 2000 Classification System for Rubber Products in Automotive Applications

AWWA C219 Bolted, Sleeve-Type Couplings for Plain End Pipe

D. Approved Manufacturers

1. Flexible Couplings

- a. Dresser Industries (Style 38)
- b. Romac Industries (C400 Series)
- c. Smith-Blair, Inc. (Style 411)

2. Flanged Coupling Adapters

- a. Dresser Industries (Style 127 or 128)
- b. Romac Industries (400 Series)
- c. Smith-Blair, Inc. (900 Series)

3. Grooved Type Couplings

- a. Victaulic Style 77

4. Transition Couplings

Transition couplings for connecting different pipes having different outside diameters shall be Dresser Style 162 couplings or Engineer approved equivalent.

PART 2 - MATERIALS

A. Construction

1. Flexible couplings shall be provided where shown, and shall be of steel with stainless steel bolts and nuts (300 Series), without pipe stop, and shall be of sized to fit the pipe and fittings shown. The middle ring shall not be less than 1/4-inch in thickness and shall be at least as thick as that specified for the size of pipe in which the coupling is to be used. Middle ring shall be 7 inches long (minimum) for pipe sizes through 24 inches and shall be 10 inches long (minimum) for pipe sizes larger than 24 inches. The followers shall be single-piece contoured mill sections, welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressure without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket.
2. Flexible couplings shall have middle rings made of steel conforming to ASTM A36, A53 (Type E or S), or A512 having a minimum yield strength of 30,000 psi. Follower rings shall be malleable iron (ASTM A47, Grade 32510), Ductile Iron (ASTM A 536), or steel (ASTM A108, Grade 1018 or ASTM A510, Grade 1018 or 1021).
3. Flanged coupling adapters shall be provided where shown and shall be cast iron bodied meeting the requirements of ASTM A-126, Class B. Flanges shall be of the size and class shown on the plans and shall mate with a standard cast iron flange meeting the requirements of ANSI B16.1. Flanged coupling adapters shall adapt plain end A.C. pipe or ductile or cast iron to cast iron, ductile iron, and steel flanges.
4. Grooved type couplings shall be Victaulic standard couplings, Style 77. Pipe ends at couplings shall be grooved-type for steel pipe and meet the manufacturer's design tolerances. Gaskets shall be molded, Grade E. Couplings shall be installed per the manufacturers printed instructions.

B. Gaskets

1. Gaskets for flexible couplings shall be a rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. The rubber in the gasket shall meet the following specifications:
 - a. Color - Jet Black
 - b. Surface - Non-Blooming
 - c. Durometer Hardness - 74 ± 5
 - d. Tensile Strength - 1000 psi Minimum
 - e. Elongation - 175 Percent Minimum
2. The gaskets shall be immune to attack by impurities normally found in water. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above.

C. Bolts and Nuts for Couplings

1. Bolts and nuts for flexible couplings, transition couplings, and flanged coupling adapters shall be stainless steel in accordance with Section 15051.
2. Bolts and nuts for Victaulic couplings shall be 300 Series Stainless Steel.

D. Gaskets

Gaskets for flanged coupling adapters shall be as described in Section 15051.

E. Painting and Coating

1. Coat flexible couplings externally and internally with a fusion bonded epoxy coating in accordance with Section 09900.
2. Flexible couplings shall be coated on their interior and exterior metal surfaces excluding seating areas and bronze and stainless steel pieces. Sandblast surfaces in accordance with SSPC SP-5. Remove all protuberances which may produce pinholes in the lining. Round all sharp edges to be coated. Remove any contaminants which may prevent ponding of the lining. Coat the interior ferrous surfaces using the following method:
 - a. Apply powdered thermosetting epoxy (Scotchkote 134 or equal) per the manufacturer's application recommendations to a thickness of 16 mils.
3. All epoxy coatings shall be applied by the coupling manufacturer.

PART 3 - EXECUTION

A. Installation

1. When installing flexible couplings or flanged coupling adapters, care shall be taken that the connecting pipe ends, couplings and gaskets are clean and free of all dirt and foreign matter with special attention being given to the contact surfaces of the pipe, gaskets and couplings. The couplings shall be assembled and installed in conformity with the recommendation and instruction of the coupling manufacturer.
2. Wrenches used in bolting flexible couplings and flanged coupling adapters shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened so as to secure a uniform annular space between the follower rings and the body of the pipe and all bolts tightened approximately the same amount. Diametrically opposite bolts shall be tightened progressively and evenly. Final tightening shall be done with a suitable, approved and calibrated torque wrench set for the torque recommended by the coupling manufacturer. All clamping torque shall be applied to the nut only.
3. All couplings which are to be buried shall be wrapped with 8-mil polyethylene wrap per AWWA C105.

B. Pipe Preparation

The ends of the pipe, where specified or shown, shall be prepared for flexible steel couplings. Plain ends for use with coupling shall be smooth and round for a distance of 12 inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

C. Backfill

1. All backfill within 24 inches of pipe couplings shall be clean, washed concrete sand.

2. Backfill is to be placed and compacted in accordance with Section 02223.

PART 4 - PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15122

SECTION 15132 GAUGES

PART 1 - GENERAL

A. Description

1. This section includes materials, testing, and installation of gauges.
2. The CONTRACTOR shall furnish and install pressure gauges as specified, complete, including all fittings, snubbers, connections, gaskets, supports, and accessories in the locations shown or specified, all in accordance with the requirements of the plans and specifications.

B. Contractor Submittals

1. The Contractor shall submit shop drawings for all gauges supplied under this section for review by the Owner in accordance with Section 01300.
2. Installation instructions shall be submitted.
3. Operation and maintenance instructions shall be submitted.

C. Approved Manufacturers

1. 3-D Instruments
2. Engineered approved equal

PART 2 - MATERIALS

A. Construction - Ordinary Service

1. Pressure gauges shall be spiral/helical coil Bourden tube type with solid front and rear blow-out plug. "C Tube" Bourdon tubes are not acceptable. Gauges shall conform to ANSI B40.1 (Grade A). Gauges shall be tapped 1/4" NPT for both back and bottom connections and shall be glycerin filled. Wetted parts shall be beryllium copper, and brass.
2. Cases shall be stainless steel or phenolic plastic.
3. The gauges shall have a 4-1/2" diameter dial and shall be of the range as shown on the plans.

B. Construction - Chlorine Service

1. All pressure and vacuum gauges as part of the chlorination equipment shall conform to the standards of the Chlorine Institute and appropriate sections of these Specifications, except that pressure snubbers and dampers may be omitted. When the standards and these specifications are in conflict, the more stringent of the two shall apply unless approved otherwise by the Engineer.

2. Pressure gauges shall be protected with diaphragm seals. Diaphragm seals shall be constructed of chlorine resistant metal.

C. Pressure Snubbers

Each pressure gauge shall have a pressure snubber between the device and the pressure source. Pressure snubbers shall be of brass construction, have 1/4" NPT male and female connections and shall be of the filter type; or snubbers may be manufacturer's standard, if supplied integral with the pressure gauge.

PART 3 - EXECUTION

A. Installation

All gauges shall be installed at the locations shown on the plans and in strict accordance with the manufacturer's printed instructions. Care shall be taken to minimize the effect of water hammer or vibrations on the gauges.

PART 4 - PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15132

SECTION 15135

METERS AND GAGES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of meters and gages required by this section is indicated on drawings
- B. Types of meters and gages specified in this section include the following:

- 1. Pressure Gages and Fittings.
 - a. Pressure Gages.
 - b. Pressure Gage Cocks.
 - c. Pressure Gage Connector Plugs.
 - d. Pressure Sensors.

- C. Magnetic Flow Meters
- D. Propeller Flow Meters

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of meters and gages, of types and sizes required, whose products have been in satisfactory use in similar service.

1.04 CODES AND STANDARDS:

- A. UL Compliance: Comply with applicable UL standards pertaining to meters and gages.
- B. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.
- C. Certification: Provide meters and gages whose accuracies, under specified operating conditions, are certified by manufacturer.

1.05 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gage. Include scale range, ratings and calibrated performance curves, certified where indicated. Submit meter and gage schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gage.

PART 2 - PRODUCTS

2.01. PRESSURE GAGES

- A. General: Provide pressure gages of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
- B. Type: General use, 1% of ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.
- C. Case: Brass or phenolic case, glass lens, 4-1/2" diameter.
- D. Connector: Brass with 1/4" male NPT. Provide pressure snubber.
- E. Scale: White coated aluminum, with permanent etched markings.
- F. Range: Conform to the following:
 - 1. Water: 0 - 200 psi.
 - 2. Compressed Air: 0 - 200 psi.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pressure gages which may be incorporated in the work are:
 - 1. Ametek/U.S. Gauge
 - 2. Marsh Instrument Co.; Unit of General Signal.
 - 3. Marshalltown Instruments, Inc.
 - 4. Trerice (H.O.) Co.
 - 5. Weiss Instruments, Inc.
 - 6. Weksler.

2.02. PRESSURE GAGE COCKS

- A. General: Provide pressure gage cocks between pressure gages and gage tees on piping systems. Construct gage cock shall be bar stock needle valve Trerice No. 735 or a full ported ball valve.
- B. Snubber: 1/4" brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.
- C. Manufacturer: Same as for pressure gages.

2.03. PRESSURE GAGE CONNECTOR PLUGS

- A. General: Provide pressure gage connector plugs pressure rated for 500 psi and 200 degrees F (93 degrees C). Construct of brass and finish in nickel-plate, equip with 1/2" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion pressure gage. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.
- B. Manufacturer: Subject to compliance with requirements, provide pressure gage connector plugs of one of the following:

1. Peterson Equipment Co.
2. Sisco.

2.04. ULTRA SONIC FLOWMETER

- A. The Flowmeter System must be a clamp-on design with no liquid contact that mounts externally on the pipe. The Flowmeter transmitter must utilize the transit-time flow measurement technique or Advanced Doppler Technique and employ the use of two microprocessors and have the ability to monitor two independent flow channels simultaneously (second channel optional.)
- B. The meter must have the ability to employ an alternate Advanced Doppler measurement technique or a Transit Time Technique for liquids with high air or solid content with the same Transmitter.
- C. The Ultrasonic Flowmeter System must be wet flow calibrated to an accuracy of better than 1% and have a calibration certificate, with 3 points minimum, accredited from an international standards agency.
- D. The Flowmeter must have a transducer encased in stainless steel for M type Transducers, or PEEK (Polyetheretheretherketone) on the K Transducers with an integral armored, stainless steel jacketed TRIAX cable. The use of COAX cable and BNC cable connections will not be acceptable.
- E. The transducers are to be mounted in a fully sealed (water tight) stainless steel mounting track and have the ability to be coupled using permanent coupling pads (grease is NOT acceptable).
- F. All transducer markings and identification must be laser scribed and solvent resistant. The use of adhesive labels for transducer identification will not be acceptable.
- G. All transducers supplied must have a multi-point (3 points minimum) wet flow calibration certificate accredited from an international standards agency with an accuracy of better than 1% or 0.5% with Process Calibration..
- H. All calibration and transducer data must reside in a non-volatile memory chip located in the transducer junction box or Flowmeter Transmitter.
- I. The meter electronics must have the ability to automatically recognize the transducers when connected.
- J. Programming of the transducer type into the meter will not be acceptable. The meter must be of a type that requires no zero calibration. The zero calibration must be factory pre-set and automatically detected, without the need for zero check/calibration after installation. There must not be any zero drift mechanisms (i.e. temperature change related drift) as the meters cannot be installed with any low-flow cutoff or “deadband”.
- K. The meter must also provide automatic Reynolds number, liquid sonic velocity compensation, and have built in liquid tables for automatic sound velocity, viscosity, and density settings.
- L. The Flowmeter electronics shall be housed in a NEMA4X enclosure and must have the ability to indicate flow rate, flow velocity, mass flow, total flow, signal strength, signal quality, liquid sonic velocity, Reynolds regime (laminar/turbulent/transition).

- M. The Flowmeter must have the ability to do dynamic (automatic) compensation for changes in viscosity and density, and temperature using real-time sonic velocity algorithms.
- N. The meter must have the ability to do dynamic (automatic) compensation for changes in viscosity, density, and temperature using real-time sonic velocity algorithms.
- O. The meter shall be capable of outputting multiple 4-20ma's, Voltage 0-1v or 0-10v, high precision frequency 0-1kHz or 0-10kHz galvanically isolated, RS-232, RS-485, binary output pulse or alarm for total and meter status.
- P. The Flowmeter shall have the ability to alarm for conditions of fault, flow direction, sound velocity limit, flow velocity limit.
- Q. The Flowmeter shall have the ability to set the 4-20ma to a settable status condition (i.e. 2ma for an alarm condition).
- R. The Flowmeter shall have Data Logging Capabilities and should have an RS-232 output and internal memory with a minimum storage of 100K data points.
- S. The Flowmeter shall include an Operations and Maintenance Manual and spare parts.
- T. The furnished Flowmeter shall be a Flexim 7407 or approved equal.

PART 3 - EXECUTION

3.01. INSPECTION

- A. Examine areas and conditions under which meters and gages are to be installed.

3.02. INSTALLATION OF PRESSURE GAGES

- A. General: Install pressure gages in piping tee with pressure gage cock, located on pipe at most readable position.
- B. Locations: As shown on the drawings.
- C. Pressure Gage Cocks: Install in piping tee with snubber.
- D. Pressure Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.03. INSTALLATION OF WATER METERS AND SENSORS

- A. Provide and install appropriate well or connection. Field verify.
- B. Locations: As shown on drawings.
- C. Manufacturer's Instructions: Follow manufacturer's instructions.

3.04. ADJUSTING AND CLEANING

- A. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.

- B. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked or broken windows; repair any scratched or marred surfaces with manufacturer's touch-up paint.

PART 4 – PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15135

SECTION 15142

WALL PIPES, SEEP RINGS, AND PENETRATIONS

PART 1 – GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of steel wall pipes and sleeves (including wall collars and seepage rings), and penetrations.

1.02 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300.
- B. Submit detail drawings for fabricated steel wall and floor pipes and sleeves, wall flanges, seep rings, and sealing materials. Show dimensions and wall thickness.
- C. Show flange sizes and the appropriate ANSI or AWWA flange dimensional standard where flanges end wall pipes or penetrations are used.
- D. Show grooved-end dimensions and AWWA grooved-end dimensional standard where grooved-end wall pipes or penetrations are used.
- E. List coating systems to be applied, manufacturer, and dry thickness of coatings. Call out coatings where coatings are to be applied.
- F. List materials of construction, with ASTM material reference and grade.
- G. Submit manufacturer's instructions for installing rubber annular hydrostatic sealing devices.

PART 2 – MATERIALS

2.01 GENERAL

Use fabricated steel wall sleeves containing rubber annular hydrostatic sealing devices through which piping passes.

2.02 FABRICATED STEEL WALL FLANGES, ANCHORS, AND SLEEVES

- A. Provide fabricated steel wall pipes with ends as shown on the drawings for connection to adjacent steel pipes, or for containing pipes, where they pass through concrete walls. Provide seepage ring or wall flange on wall pipes and sleeves passing through concrete walls and slabs which are to be watertight. Wall thickness shall be the same as the pipe wall thickness when connecting to steel pipe. Wall thickness for sleeves containing pipes shall be standard weight per ANSI B36.10.
- B. Wall flanges shall be in the form of a steel wall collar welded to the steel sleeve or penetration. Cut welded wall collars from a steel ring of the size indicated on the drawings. Attach the collar to a steel wall pipe or sleeve with full circle fillet welds. Welding procedures shall be in accordance with ANSI B31.3, Chapter V.
- C. Steel pipe used in fabricating wall sleeves containing pipes shall comply with ASTM A 53, Grade B; ASTM A 135, Grade B; ASTM A 139, Grade B; or API 5L or 5LX. Wall sleeves connecting to steel pipe shall be of the same material as the connecting pipe. Wall collar material shall comply with ASTM A 105, A 181, or A 182.

2.03 RUBBER ANNULAR HYDROSTATIC SEALING DEVICES

- A. Rubber annular hydrostatic sealing devices shall be of the modular mechanical type, utilizing interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe sleeve and the passing pipe. Assemble links to form a continuous rubber belt around the pipe, with a pressure plate under each bolthead and nut. Rubber link seal shall be Linkseal manufactured by Thunderline Corporation; or Engineer approved equal.
- B. Materials of construction shall be as follows:

COMPOUND	MATERIAL
Pressure Plate	Stainless Steel
Bolts and Nuts for Links	Type 303 or 316 Stainless Steel
Sealing Element	EPDM Rubber

- C. The size of the wall sleeve needed to accommodate the passing pipe shall be as recommended by the rubber annular seal manufacturer.

2.04 POLYETHYLENE FOAM FILLER FOR PIPE PENETRATIONS

Packing foam shall be an extruded closed-cell polyethylene foam rod, such as Minicel baker rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware; Ethaform, as manufactured by Dow Chemical District, Midland, Michigan; or equal. The rod shall be 1/2 inch larger in diameter than the annular space.

2.05 PAINTING AND COATING

- A. Coat penetrations and sleeves exposed, above ground, or in vaults and structures in accordance with Section 09900.
- B. Coat buried sleeves and penetrations per Section 09900.

PART 3 – EXECUTION

3.01 LOCATION OF PIPES AND SLEEVES

- A. Provide a wall or floor pipe sleeve where shown on the drawings.
- B. Provide a floor sleeve where shown on the drawings and wherever plastic pipe, carbon steel or stainless steel pipe 3 inches and smaller or copper tubing passes through a floor or slab. Provide a rubber annular sealing device in the annular space between the sleeve and the passing pipe or tubing.
- C. Provide wall sleeves where shown on the drawings and wherever plastic pipe, steel or stainless-steel pipe 3 inches and smaller, or stainless-steel or copper tubing passes through a wall. Provide a single rubber annular seal when the wall is 8 inches thick or less. Provide two rubber annular seals (one at each end of the sleeve) when the wall is more than 8 inches thick. Pack the annular space with polyethylene foam filler and fill the ends of the penetration with 2 inches of elastomeric sealant on both sides of the structure.
- D. Where sleeves are installed in which water or soil is on one or both sides of the channel or wall, provide two rubber annular seals (one at each end of the sleeve).
- E. Where pipes pass through walls or slabs and no sleeves or wall or floor pipe with seep ring is provided, pack the annular space with polyethylene foam filler and fill the ends of the penetration with 2 inches of elastomeric sealant on both sides of the structure.

3.02 INSTALLATION IN EXISTING CONCRETE WALLS AND SLABS

Core drill holes 2 inches larger in diameter than the diameter of the wall flange or collar. Install wall pipe and collar assembly axially aligned with the piping to which it will be connected or will contain. Pack the void space between the sleeve and concrete with waterproof epoxy grout.

3.03 INSTALLATION IN NEW CONCRETE WALLS AND SLABS

Install wall pipes in walls before placing concrete. Do not allow any portion of the sleeve to touch any of the reinforcing steel. Install wall sleeve and collar assembly axially aligned with the piping to which it will be attached or will contain.

3.04 INSTALLATION OF WALL PIPES HAVING FLANGED END CONNECTIONS

- A. Check alignment before grouting in place or pouring concrete. Realign if the sleeve is not properly aligned.
- B. Install flanged end wall sleeves or penetrations with bolt holes of the end flanges straddling the horizontal and vertical centerlines of the sleeve.
- C. Lubricate flange bolts with oil and graphite prior to installation.

3.05 QUALIFICATIONS OF WELDERS

Welder qualifications shall be in accordance with AWS B3.0.

3.06 INSTALLATION OF RUBBER ANNULAR HYDROSTATIC SEALING DEVICES

Install in accordance with the manufacturer's instructions.

PART 4 – PAYMENT

Payment of the work in this section will be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15142

SECTION 15144

PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of pipe hangers and supports including accessory items, such as anchor bolts and screws and neoprene isolation pads.

1.02 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300.
- B. Provide line drawings of each typical piping system to the scale shown on the drawings, locating each support or hanger. Identify each type of hanger or support by the manufacturer's catalog number or figure.
- C. Provide installation drawings and manufacturer's catalog information on each type of hanger and support used.

PART 2 - MATERIALS

2.01 DESIGN CRITERIA

- A. No attempt has been made to show or detail in the drawings every pipe support or hanger required. Provide pipe supports for every piping system installed.
- B. Pipe support and hanger components shall withstand the dead loads imposed by the weight of the pipes filled with water and shall have a minimum safety factor of five based on material ultimate strength.

2.02 HANGER AND SUPPORT SYSTEMS

- A. Pipe hangers and supports shall comply with MSS SP-58 for the standard types referenced on the drawings. Construct special hangers and supports as detailed on the drawings. Type numbers for standard hangers and supports shall be in accordance with MSS SP-58 as listed below:

Type Number	Description	Manufacturer and Model (Or Equal)
1	Adjustable Steel Clevis	Ginnel Fig. 590 or 260, Kin-Line 473, Grinnell Fig. 295A or 295H
3	Steel Double-Bolt Pipe Clamp	Kin-Line 473, Ginnel Fig. 295A or 295H
5	Pipe Hanger	Kin-Line 450
7	Adjustable Steel Band Hanger	Grinnell Fig. 269, Atlanta Engineering Fig. 22
8	Extension Pipe or Riser Clamp	Grinnell Fig. 261, Atlanta Engineering Fig. 39
9	Adjustable Band Hanger	Grinnell Fig. 97
10	Adjustable Swivel Ring Band Hanger	Grinnell Fig. 97
13	Steel Turnbuckle	Grinnell Fig. 230
14	Steel Clevis	Grinnell Fig. 299
15	Swivel Turnbuckle	Grinnell Fig. 114
18	Steel or Malleable Iron Concrete Insert	Grinnell Fig. 281, Superstrut 452
24	U-Bolt	Grinnell Fig. 137, Kin-Line 437

26	Clip	Grinnell Fig. 262, Kin-Line 477
31	Light Welded Steel	Grinnell Fig. 194
32	Medium welded Steel Bracket	Grinnell Fig. 195
33	Heavy Welded Steel Bracket	Grinnell Fig. 199
36	Pipe Saddle Support	Grinnell Fig. 258
37	Pipe Stanchion Saddle	Grinnell Fig. 259, Kin-Line 467
38	Adjustable Pipe Saddle Support	Grinnell Fig. 264, Atlanta Engineering Fig. 308

- B. Pipe hangers and supports shall be hot-dipped galvanized per ASTM A 153 carbon steel (ASTM A 36, A 575, or A 576). Bases, rollers, and anchors shall be steel as described above or may be cast iron (ASTM A 48). Pipe clamps shall be steel as described above or may be malleable iron (ASTM A 47).
- C. Pipe hangers and supports shall be as manufactured by Grinnell, Kin-Line, Unistrut, Superstrut, or equal.

2.03 OFFSET PIPE CLAMP

Grinnell Figure 103 or equal. Material shall be Type 316 stainless steel.

2.04 ANCHOR BOLTS AND SCREWS

Anchor bolts and screws for attaching pipe supports and hangers to walls, floors, ceilings, and roof beams shall be Type 316 stainless steel, ASTM A 276. Nuts shall be type 316 stainless steel, ASTM A 194, Grade 8M, or ASTM F 594, Type 316 stainless steel.

2.05 NEOPRENE ISOLATING SLEEVES FOR METAL PIPE 2 INCHES AND SMALLER

Unistrut P2600, Kin-Line 418 and 419, or equal.

PART 3 - EXECUTION

3.01 PIPE HANGER AND WALL SUPPORT SPACING

Install pipe hangers and wall supports on horizontal and vertical runs at the spacing shown or detailed on the drawings. Provide hanger rods (for horizontal runs) and wall supports of the sizes shown or detailed on the drawings. If no spacing or rod sizes are given in the drawings or in the specifications for a particular piping system, use the following:

- A. Pipe Hanger and Wall Support Spacing for Steel Pipe:

Pipe Size (Inches)	Maximum Support or Hanger Spacing (Feet)	Minimum Rod Size (Inches)
3/8 and Smaller	4	3/8
1/2 Through 1	6	3/8
1-1/4 Through 2	8	3/8
2-1/2 and 3	10	1/2
3-1/2 and 4	10	5/8
6	12	3/4
8	12	7/8
10 and 12	14	7/8
14 and 16	16	1
18	15	1
20 Through 24	9	1
30	6	1

B. Pipe Hanger or Wall Support Spacing for PVC Pipe

Maximum Support Pipe Size (Inches)	Minimum Road or Hanger Spacing (Feet)	Size (Inches)
3/4	4	3/8
1	4	3/8
1-1/2	5	3/8
2	5	3/8
2-1/2	5	1/2
3 Through 6	6	1/2

- C. Provide sway bracing for hangers where detailed on the drawings. If no bracing is detailed, provide bracing at 10-foot-maximum center-to-center intervals.

3.02 PIPE SUPPORT SPACING FOR SUPPORTS ON TOP OF SLABS OR GRADE

Install pipe supports on horizontal runs at the spacing shown or detailed on the drawings. Provide supports of the type shown or detailed on the drawings. If no spacings are given on the drawings or in the specifications for a particular piping system, use the following:

A. Pipe Support Spacing for Steel Pipe:

Pipe Size (Inches)	Maximum Support Spacing (Feet)
3/8 And Smaller	4
1/2 Through 1	6
1-1/4 Through 2	8
2-2 1/2 And 3	10
3-1/2 And 4	10
6	12
8	12
10 And 12	14
14 And 16	16
18	16
20 Through 24	18
30	18

- B. Pipe support spacing for other pipe materials shall be the same as described above in Section A.

3.03 INSTALLING PIPE HANGERS AND SUPPORTS

- A. Provide separate hangers and supports at valves. Provide one hanger or support around each end of the valve body or on the adjacent connecting pipe within one pipe diameter of the valve end.
- B. Provide separate hangers and supports at each pipe elbow, tee, or fitting. Provide separate hangers and supports on both sides of each nonrigid joint or flexible pipe coupling.
- C. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, and other equipment to which the pipe is connected.
- D. Use 1-5/8-inch-high channel frames unless 3-1/4-inch is needed to provide clearance from walls. Use multiple back-to-back channels if additional clearance is needed.

3.04 INSTALLING NEOPRENE ISOLATING SLEEVES

Install a sleeve around each metal pipe 2 inches and smaller at the point of bearing or contact with the pipe hanger or support.

E. Painting and Coating

Paint exposed nongalvanized pipe hangers and supports to match the color of the adjacent wall per Section 09900. Coat galvanized pipe supports per Section 09900. Color of finish coat shall match adjacent piping. If the adjacent wall is not painted, paint the hangers and supports to match color code of the largest pipe on the support.

PART 4 - PAYMENT

Payment of the work in this section will be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15144

SECTION 15150 FLOWMETER

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of the electromagnetic flowmeter.

B. Contractor Submittals

The Contractor shall submit shop drawings for all flowmeters as well as catalog data installation instructions and operation and maintenance instructions in accordance with Section 01300.

D. Acceptable Manufacturers

1. Electromagnetic Flowmeter - Fisher-Rosemount No. 8705TSA160C1W1NOG1D1Q4 with Fisher-Rosemount Model 8712CR12NOM4C101 Transmitter.
2. Engineer approved equal.

PART 2 - MATERIALS

A. General

1. Flow instrumentation shall include flowmeter, indicator, totalizer, transmitter, and remote digital display for display of flow rate and totalizer.
2. Meters shall be new and of current design and manufacture.
3. All parts of the same size and model meter shall be interchangeable.

B. Electromagnetic Flowmeter

1. Flowmeter body shall be lined with Teflon lining. Body shall have flanged ends rated for 150 psi working pressure.
2. Electrodes shall be removable and shall be constructed of 316L stainless steel. Grounding rings shall be used and shall be constructed of 316L Stainless Steel.
3. The transmitter shall be remotely mounted.
4. The flowmeter transmitter shall operate on 120 VAC, 60 Hz power, and shall be equipped with empty pipe detection.
5. Standard features shall include flanged connections, low-flow, cut-off, built-in noise rejection, field programming capability, selectable damping, user defined engineering units, bi-directional flow, positive zero return, isolated analog output (4-20 ma), and scaled pulse output, self-test function, 16-digit display, rate and total, and security lockout.
6. Rate shall read in gallons per minute. Totalizer shall read in 1000's of gallons.
7. The accuracy shall be ½ of 1% of rate over a 33:1 turndown at all flow rates above 1 fps. Accuracy shall be verified by calibration in a flow laboratory traceable to the NIST (National Institute of Standards and Technology). If desired, the test shall be witnessed by the Owner.
8. Isolated output shall be 4-20 ma dc into 800 ohms with frequency output to be compatible

with driven equipment.

9. Flowmeter shall be field programmable using a Rosemount 275 portable programmer.

D. Stainless Steel Hardware

All bolts, nuts, capscrews, studs, and washers shall be Type 316 stainless steel.

PART 3 - EXECUTION

A. Installation

1. Meter installation shall be in conformance with the manufacturers printed instructions.
2. Flush new pipelines before installing meters. Avoid rapid expulsion of large slugs of entrained air.
3. Meter shall not be used to connect misaligned pipes.

B. Testing

1. All meter installations shall be hydrostatically pressure tested during the testing of pipeline in accordance with Section 15042.
2. All meters will be tested by the manufacturer to verify its accuracy prior to being put into service. Calibration data shall be supplied with the meter.
3. The meters shall be calibrated and started up by the manufacturer of the meter.

PART 4 - PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15150

SECTION 15162

FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS

PART 1 – GENERAL

1.01 Description

- A. This section describes materials and installation of flexible gasket sleeve-type compression pipe couplings for steel, pipe and ductile iron pipe.

1.02 Related Work Specified Elsewhere

- A. Painting and Coating: 09900.
- B. Hydrostatic Testing of Pressure Pipelines: 15042.

1.03 Submittals

- A. Shop drawings shall be in accordance with Section 01300 and the following.
- B. Submit manufacturer's catalog data on flexible pipe couplings. Show manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings are used.
- C. Submit manufacturer's recommended torques to which the coupling bolts shall be tightened for the flexible gasket sleeve-type compression pipe couplings.
- D. Show materials of construction by ASTM reference and grade. Show dimensions.
- E. Show number, size, and material of construction of the rods and lugs for each thrust harness on the project.

PART 2 - MATERIALS

2.01. Flexible Pipe Couplings for Steel Pipe

- A. General: Steel couplings shall have center sleeves made of steel conforming to ASTM A 36, A 53 (Type E or S), or A 512 having a minimum yield strength of 30,000 psi. Follower rings shall be malleable iron (ASTM A 47, Grade 32510), ductile iron (ASTM A 536), or steel (ASTM A 108, Grade 1018, or ASTM A 510, Grades 1018 or 1021). Follower ring material shall match that of the pipe being joined (i.e., steel follower rings on steel pipe; malleable iron rings for ductile iron pipe). Minimum center sleeve length shall be 5-inches for pipe sizes 3/4-inch through 3-inches; 7-inches for pipe sizes 4-inches through 10-inches; and 10-inches for pipe sizes 6-inches through 24-inches. Center sleeve and follower rings shall be fusion bonded epoxy coated.
- B. Sleeve Bolts: Sleeve bolts shall have a minimum yield strength of 40,000 psi, an ultimate strength of 60,000 psi, shall be fabricated of Type 316 stainless steel conforming to ASTM A 193 (Grade B8M) for bolts and ASTM A 194 (Grade B8M) for nuts, and shall conform to AWWA C111.
- C. Manufacturers: Flexible pipe couplings for steel pipe shall be steel, and shall be Dresser, Smith-Blair Type 411, Baker Series 200, Ford, Romac or approved equal.

2.02. Joint Harness

- A. Tie Bolts or Studs: Tie bolts or studs shall be as shown in AWWA Manual M11, Table 13-6, 13-7, and 13-7A. The minimum numbers and sizes of tie bolts or studs shall be as shown in the table below. Bolt or stud material shall conform to ASTM B 193, Grade B8. Nuts shall conform to ASTM A 194, Grade B8M. Lug material shall conform to ASTM A 36, ASTM A 283, Grade B, C, or D, or ASTM A 285, Grade C. Lug dimensions, plate thickness, and weld dimensions shall be as shown in AWWA Manual M11, Figure 13-17.

TIE BOLTS OR STUD REQUIREMENTS FOR FLEXIBLE PIPE COUPLINGS

Tie Bolt or Stud Minimum Requirements				
Nominal Pipe Size (inches)	150 psi		250 psi	
	No. Bolts or Studs	Size (inches)	No. Bolts or Studs	Size (inches)
2	2	5/8	2	5/8
3	2	5/8	2	5/8
4	2	5/8	2	5/8
6	2	5/8	2	5/8
8	2	5/8	2	5/8
10	2	5/8	2	3/4
12	2	3/4	2	7/8
14	2	3/4	2	1
16	2	7/8	2	1-1/8
18	2	1	2	1-1/4
20	2	1	2	1-1/4
24	4	7/8	4	1-1/8

Tie Bolt or Stud Minimum Requirements				
Nominal Pipe Size (inches)	150 psi		250 psi	
	No. Bolts or Studs	Size (inches)	No. Bolts or Studs	Size (inches)
30	4	1-1/8	4	1-3/8
36	4	1-1/4	4	1-5/8
42	4	1-1/2	6	1-1/2
48	6	1-5/8	6	1-3/4
54	6	1-1/2	8	1-3/4
60	6	1-5/8	10	1-5/8
66	8	1-5/8	12	1-3/4
72	8	1-3/4	12	1-7/8
84	10	1-3/4	14	2
96	12	1-7/8	16	2-1/4

- B. Criteria for Number and Size of Tie Bolts or Studs: The number and size of bolts shall be selected based on the test pressure shown in Section 15042, Hydrostatic Testing of Pressure Pipelines. For test pressures less than or for contracts between Owner and Contractor, approved equal to 150 psi, the 150-psi design in the table above shall be used. For test pressures between 150 and 250 psi, the 250-psi design in the table above shall be used.
- C. Washers: Stainless steel, Type 316 washers shall be provided for each lug. Washer material shall be the same as the nuts. Minimum washer thickness shall be 1/8-inch.
- D. Wall Thickness Requirement for Welded Lugs: Pipe wall to which lugs are welded shall be adequate to resist stresses. If necessary, the pipe wall thickness shall be increased.

2.03. Flexible Pipe Couplings for Asbestos-Cement Pipe Not used

2.04. Flexible Couplings for Ductile Iron Pipe

- A. General: Ductile iron pipe couplings shall have sleeves of ASTM A 126 Class B ductile iron with a minimum yield strength of 30,000 psi. Follower rings shall be malleable iron ASTM A 47 Grade 32510 or ductile iron ASTM A 536. Minimum center sleeve length shall be 7 inches for pipe sizes up to 6-inches and shall be 10 inches for larger pipe diameters. Center sleeve and follower rings shall be fusion bonded epoxy coated.
- B. Sleeve Bolts: Sleeve bolts shall be corrosion resistant Type 316 stainless steel with minimum yield strength of 45,000 psi and shall conform to ASTM A 193 and AWWA C111.
- C. Manufacturers: Flexible couplings for ductile iron pipe shall be ductile iron: Dresser Style 153, Smith-Blair Type 442, Baker Series 228, Ford Style FCI, Romac Style 501, or approved equal.

2.05. Transition Couplings

- A. Steel Pipe and Concrete Cylinder Pipe: Transition couplings for connecting steel pipe and concrete cylinder pipe having different outside diameters shall be steel: Center sleeve and follower rings shall be fusion bonded epoxy coated. Dresser Style 62 or 162, Smith-Blair Type 413, Baker Series 212 or 240, or approved equal.
- B. Ductile Iron Pipe, PVC Pipe, and Asbestos Cement Pipe: Transition couplings for connecting ductile iron pipe, PVC pipe, and asbestos cement pipe having different outside diameters shall be ductile iron, and shall be Smith-Blair Type 441, Baker Series 236, Ford Style FC2A, Romac, Dresser or approved equal. Center sleeve and follower rings shall be fusion bonded epoxy coated.
- C. Sleeve Bolts: Sleeve bolts shall have a minimum yield strength of 40,000 psi, an ultimate strength of 60,000 psi, shall be Type 316 stainless steel conforming to ASTM A 193 (Grade B8M) for bolts and ASTM A 194 (Grade B8M) for nuts, and shall conform to AWWA C111.

2.06. Reducing Couplings

- A. Reducing couplings for steel pipe shall be steel. Reducing couplings for ductile iron pipe, PVC pipe, and asbestos cement pipe shall be ductile iron. Center sleeve and follower rings shall be fusion bonded epoxy coated. Couplings shall be Dresser Style 62, Baker Series 220 or 240, Smith-Blair Type 415 or R441, Romac, Ford or approved equal.

2.07. Flanged Coupling Adapters

- A. Where detailed on the approved plans, flanged coupling adapters may be used to install valves, meters, and other types of flanged fittings to plain end pipe of diameter 10-inches and smaller. Center sleeve and follower rings shall be fusion bonded epoxy coated. Flanged coupling adapters shall be Smith-Blair Type 912, Baker Series 601 or 604, Dresser Style 127, Ford Style FFCA, Romac Style FAC501, or approved equal.

2.08. Expansion Joints

- A. General: Expansion joints shall have body, flanges, and slip pipe of carbon steel. Packing shall consist of a minimum of four rubber rings, each separated by jute packing. For installation in steel pipelines, expansion joint shall have plain ends, beveled for welding. For installation in ductile iron pipelines, expansion joint shall have plain ends. Slip pipe shall have a machined

surface, and body shall be equipped with pipe stops. Center sleeve and follower rings shall be fusion bonded epoxy coated. Where called for on the plans, limit or stop rings and limit rods shall be provided to prevent the slip pipe from pulling out of the joint.

- B. Limit Rods and Body Studs, Bolts and Nuts: Limit rods and body studs, bolts, and nuts shall be Type 316 stainless steel conforming to ASTM A 193 (Grade B8M) for rods and bolts, and ASTM A 194 (Grade B8M) for nuts.
- C. Manufacturers: Expansion joints shall be Baker Series 403 or 404, Smith-Blair Type 611 or 612, or approved equal.

2.09. Sleeve Bolts and Nuts for Flanges

- A. Stainless Steel Bolts: Bolts and nuts for buried and submerged flanges, flanges in underground vaults and structures, and flanges located outdoors above ground shall be Type 316 stainless steel conforming to ASTM A 193 (Grade B8M) for bolts and ASTM A 194 (Grade B8M) for nuts.
- B. Washers: Washers shall be provided for each nut. Washers shall be of the same material as the nuts.

PART 3 - EXECUTION

3.01. Installation of Flexible Pipe Couplings and Expansion Joints

- A. General: Oil, scale, rust, and dirt shall be cleaned from pipe ends. Gaskets in flexible pipe couplings shall be cleaned before installing. Expansion joints shall be installed per manufacturer's recommendations. Expansion joints shall be installed so that 50% of total travel is available for expansion and 50% is available for contraction.
- B. Bolt Thread Lubrication: Bolt threads shall be lubricated with anti-seize compound prior to installation.

3.02. Painting and Coating

- A. Flexible Couplings: Flexible pipe couplings (including joint harness assemblies), transition couplings, flanged coupling adapters, and expansion joints shall be coated per Section 09900, Painting and Coating; sleeves shall be coated per System G-1. After installation couplings shall be wrapped with 8- mil polyethylene wrap per AWWA C105.
- B. Interior Surface Coating: Interior surfaces of flexible coupling and transition coupling sleeves, and the body of expansion joints shall be coated per Section 09900, Painting and Coating, System G-1.

3.03. Bonding Flexible Pipe Couplings

- A. Buried flexible pipe couplings that are connected to ductile-iron, cast-iron, or steel pipe shall be bonded to adjacent piping.

3.04. Hydrostatic Testing

- A. Flexible pipe couplings, expansion joints, and expansion joints shall be hydrostatically tested in place with the pipe being tested. Test shall be performed in accordance with Section 15042, Hydrostatic Testing of Pressure Pipelines.

PART 4 – PAYMENT

Payment of the work in this section shall be included as part of the lump sum bid amount stated in the Proposal for items of work to which it is appurtenant.

END OF SECTION 15162

STANDARD DRAWINGS AND DETAILS SECTION

INDEX

DESCRIPTIONS

DRAWING 2

TYPICAL CUT-TO-FIT DETAILS FOR TYPES I,II,III, & IV

DRAWING 4

TYPICAL EXCAVATION BACKFILL SCHEMATIC

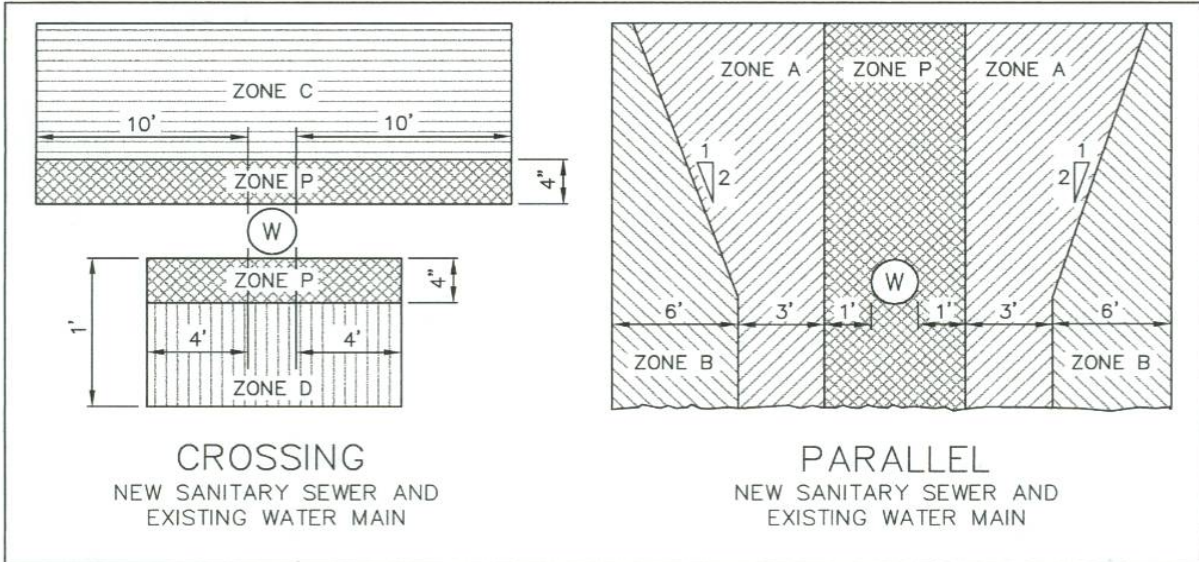
DRAWING 6

BUTTERFLY VALVE INSTALLATION

DRAWING 13

THRUST BLOCKS FOR STEEL AND D.I.P. PIPELINES, 225 P.S.I. MAX

STANDARD DRAWINGS AND DETAILS



A	SEWER LINES WILL NOT BE PERMITTED IN THIS ZONE WITHOUT SPECIAL PERMISSION FROM THE DEPARTMENT OF HEALTH SERVICES, STATE OF CALIFORNIA.
B	EXTRA STRENGTH VITRIFIED CLAY PIPE WITH COMPRESSION JOINTS; OR PLASTIC SEWER PIPE WITH RUBBER RING JOINTS (PER ASTM D3034) OR EQUIVALENT; OR CAST OR DUCTILE IRON PIPE WITH COMPRESSION JOINTS; OR REINFORCED CONCRETE PRESSURE PIPE WITH COMPRESSION JOINTS (PER AWWA C302-74).
C	DUCTILE IRON PIPE WITH HOT DIP BITUMINOUS COATING AND MECHANICAL JOINTS; OR A CONTINUOUS SECTION OF CLASS 200 (DR 14 PER AWWA C900) PLASTIC PIPE OR EQUIVALENT; OR A CONTINUOUS SECTION OF REINFORCED CONCRETE PIPE (PER AWWA C302-74); OR ANY SEWER PIPE WITHIN A CONTINUOUS SLEEVE.
D	A CONTINUOUS SECTION OF DUCTILE IRON PIPE WITH HOT DIP BITUMINOUS COATING; OR A CONTINUOUS SECTION OF CLASS 200 (DR 14 PER AWWA C900) PLASTIC PIPE OR EQUIVALENT; OR A CONTINUOUS SECTION OF REINFORCED CONCRETE PIPE (PER AWWA C302-74); OR ANY SEWER PIPE WITHIN A CONTINUOUS SLEEVE; OR ANY SEWER PIPE SEPARATED BY A 10 FOOT x 10 FOOT, 4 INCH THICK REINFORCED CONCRETE SLAB.
P	ZONE P IS A PROHIBITED ZONE, SECTION 64630 (e) (2) CALIFORNIA ADMINISTRATION CODE, TITLE 22.

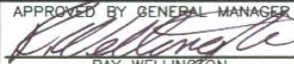
NOTES:

1. (W) INDICATES WATER MAIN. DIMENSIONS ARE FROM OUTSIDE OF WATER PIPE TO OUTSIDE OF SEWER PIPE.
2. SEWER MAINS SHALL BE INSTALLED AS FAR FROM WATER MAIN AS POSSIBLE. IF THE HORIZONTAL SEPARATION BETWEEN SEWER AND WATER MAIN MUST BE LESS THAN 10 FEET AND THE SEWER IS NOT MORE THAN 1 FEET BELOW THE WATER MAIN, SPECIAL CONSTRUCTION AS SHOWN ABOVE IS REQUIRED.
3. IN CASES WHERE THE SEWER MAIN CROSSES A WATER MAIN, A FULL JOINT OF SEWER PIPE SHALL BE CENTERED ON THE WATER MAIN.
4. BUILDING LATERALS SHALL BE INSTALLED BELOW WATER MAIN. IF THIS CONDITION CANNOT BE MET, SPECIAL CONSTRUCTION WILL BE REQUIRED AS SHOWN ABOVE.
5. SEWER MAINS SHALL NOT BE INSTALLED WITHIN 25 FEET OF A LOW HEAD (5 PSI OR LESS) WATER MAIN WITHOUT PRIOR APPROVAL OF THE DEPARTMENT OF HEALTH SERVICES, STATE OF CALIFORNIA.
6. SEWER MAINS SHALL BE PRESSURE TESTED WHEN SPECIAL CONSTRUCTION IS REQUIRED AS SHOWN ABOVE.

SHEET 1 OF 2



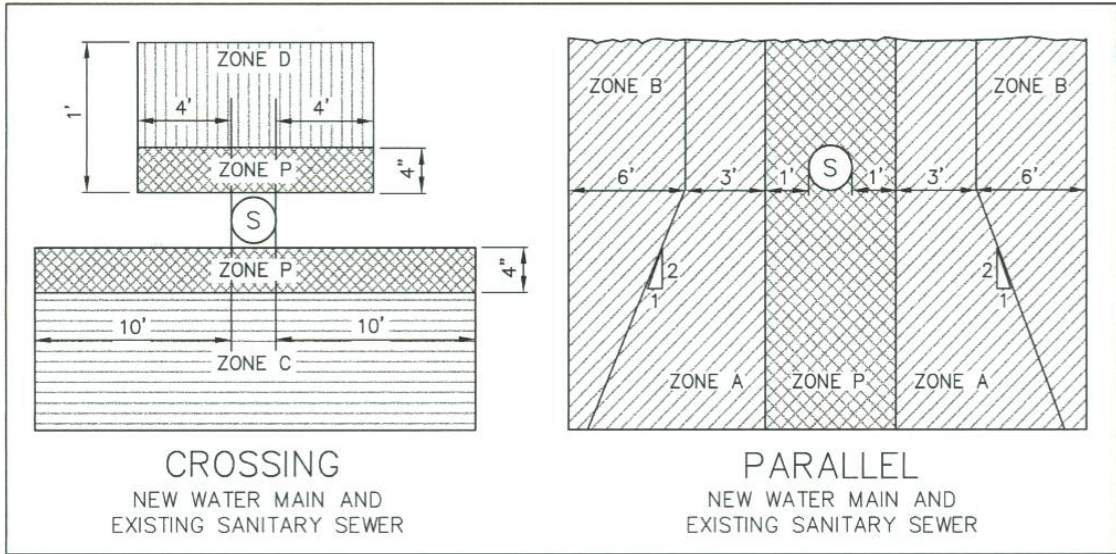
SEPARATION CRITERIA FOR EXISTING WATER MAINS AND NEW SANITARY SEWERS

APPROVED BY GENERAL MANAGER

 RAY WELLINGTON

STANDARD DRAWING No.
SAWCO-1 (1 of 2)

REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS



A	WATER MAINS WILL NOT BE PERMITTED IN THIS ZONE WITHOUT SPECIAL PERMISSION FROM THE DEPARTMENT OF HEALTH SERVICES, STATE OF CALIFORNIA.
B	THE WATER MAIN SHALL BE CONSTRUCTED OF: DUCTILE IRON PIPE WITH HOT DIP BITUMINOUS COATING; DIPPED AND WRAPPED 1/4" THICK WELDED STEEL PIPE; REINFORCED CONCRETE PIPE, STEEL CYLINDER TYPE (PER AWWA C300-74, C301-79 OR C303-70).
C	THE WATER MAIN SHALL HAVE NO JOINTS IN ZONE C AND BE CONSTRUCTED OF: DUCTILE IRON PIPE WITH HOT DIP BITUMINOUS COATING; DIPPED AND WRAPPED 1/4" THICK WELDED STEEL PIPE; REINFORCED CONCRETE PRESSURE PIPE, STEEL CYLINDER TYPE (PER AWWA C300-74, C301-79 OR C303-70).
D	THE WATER MAIN SHALL HAVE NO JOINTS WITHIN FOUR FEET FROM EITHER SIDE OF THE SEWER AND SHALL BE CONSTRUCTED OF: DUCTILE IRON PIPE WITH HOT BITUMINOUS COATING; DIPPED AND WRAPPED 1/4" THICK WELDED STEEL PIPE; REINFORCED CONCRETE PIPE, STEEL CYLINDER TYPE (PER AWWA C300-74, C301-79 OR C303-70)
P	ZONE P IS A PROHIBITED ZONE, SECTION 64630 (e) (2) CALIFORNIA ADMINISTRATION CODE, TITLE 22.

- NOTES:**
- ① INDICATES SANITARY SEWER MAIN. DIMENSIONS ARE FROM OUTSIDE OF WATER PIPE TO OUTSIDE OF SEWER PIPE.
 - SEWER LINES SHALL BE INSTALLED AS FAR FROM WATER MAIN AS POSSIBLE. IF THE HORIZONTAL SEPARATION BETWEEN SEWER AND WATER MAIN MUST BE LESS THAN 10 FEET AND THE SEWER IS NOT MORE THAN 1 FEET BELOW THE WATER MAIN, SPECIAL CONSTRUCTION AS SHOWN ABOVE IS REQUIRED.
 - IN CASES WHERE THE SEWER LINE CROSSES A WATER MAIN, A FULL JOINT OF WATER PIPE SHALL BE CENTERED ON THE SEWER MAIN.
 - BUILDING LATERALS SHALL BE INSTALLED 4" OR MORE ABOVE SEWER MAIN. IF THIS CONDITION CANNOT BE MET, SPECIAL CONSTRUCTION WILL BE REQUIRED AS SHOWN ABOVE.
 - A LOW HEAD (5 PSI OR LESS) WATER MAIN SHALL NOT BE INSTALLED WITHIN 25 FEET OF SEWER MAINS WITHOUT PRIOR APPROVAL OF THE DEPARTMENT OF HEALTH SERVICES, STATE OF CALIFORNIA.
 - A NEW WATER MAIN CROSSING OVER AN EXISTING SEWER FORCE MAIN SHALL BE CONSTRUCTED OF MATERIALS WITH A MINIMUM RATING OF 200 PSI

SHEET 2 OF 2

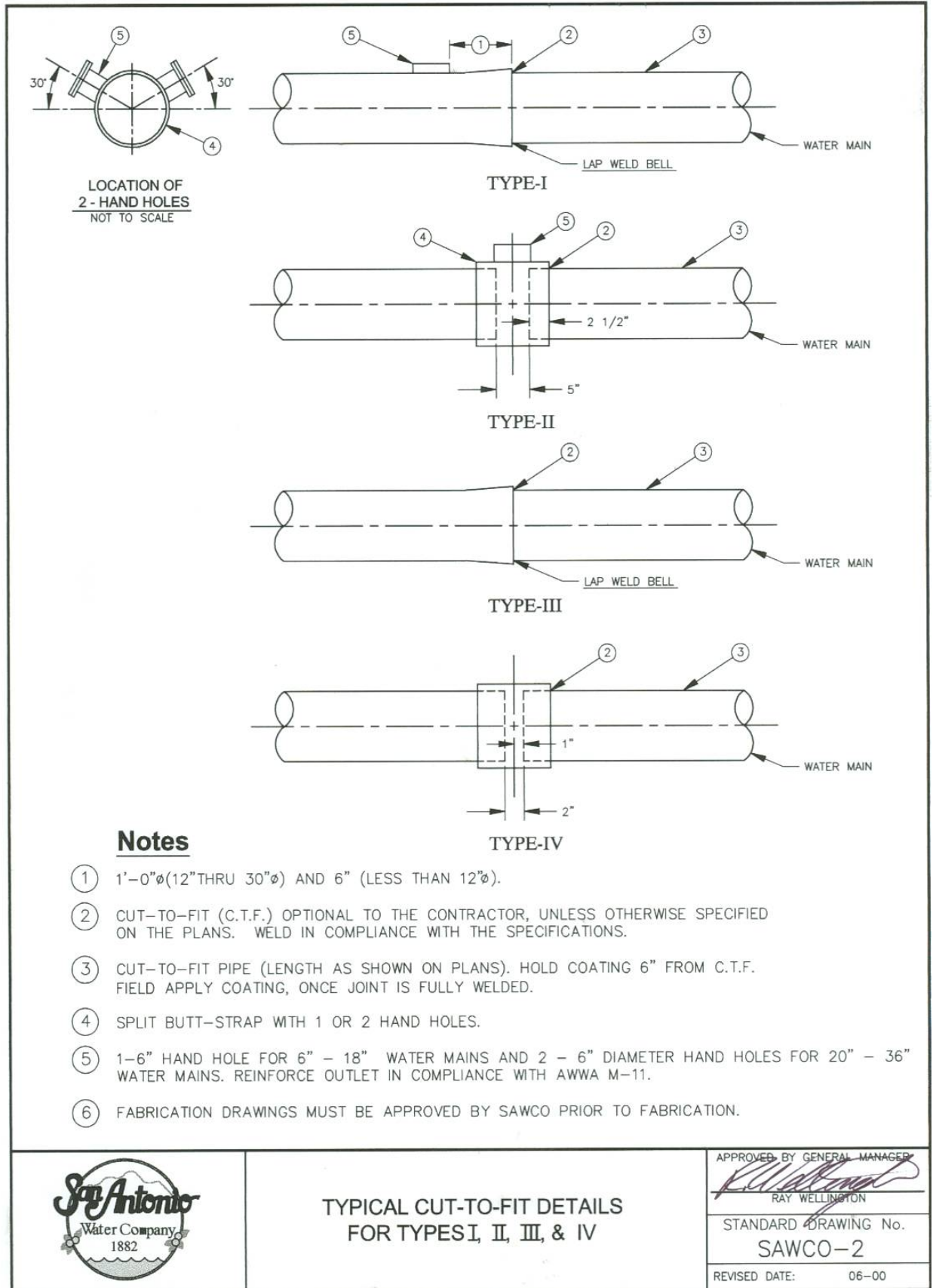


SEPARATION CRITERIA FOR NEW WATER MAINS AND EXISTING SANITARY SEWERS

APPROVED BY GENERAL MANAGER

 RAY WELLINGTON
 STANDARD DRAWING No.
SAWCO-1 (2 of 2)
 REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS

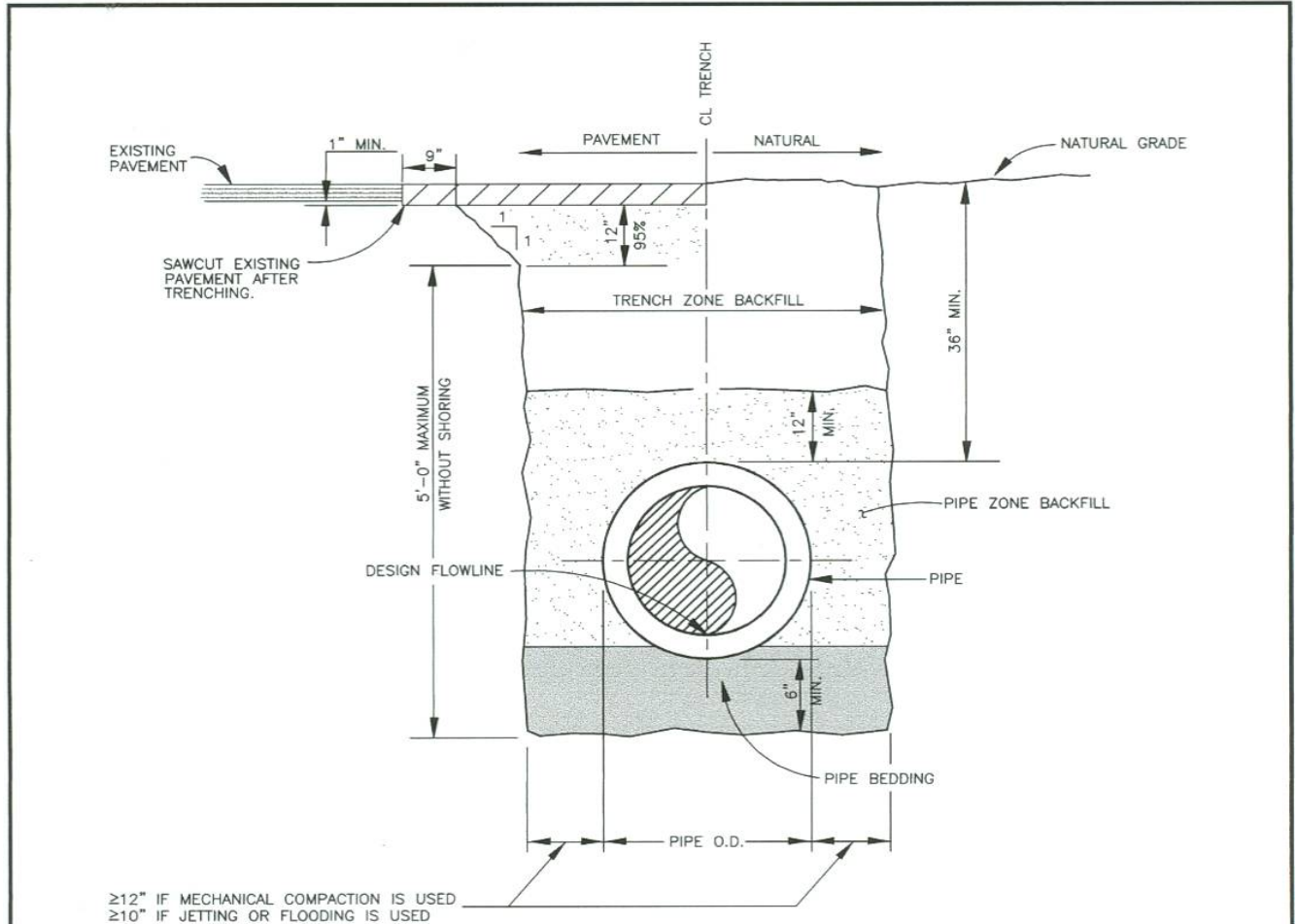


TYPICAL CUT-TO-FIT DETAILS FOR TYPES I, II, III, & IV

APPROVED BY GENERAL MANAGER

 RAY WELLINGTON
 STANDARD DRAWING No.
SAWCO-2
 REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS



Trench Zone Backfill Material:

COMPACTED TO 90% OF ASTM D-1557-91 SELECT MATERIAL OR APPROVED IMPORT.

IF MECHANICAL COMPACTION IS USED, MATERIAL MAY NOT BE GREATER THAN 3 INCHES IN ANY DIMENSION.

IF FLOODING OR JETTING IS USED, MATERIAL MUST MEET THE FOLLOWING:

1/2" 100% PASSING
 #200 0% - 10% PASSING
 (SE ≥ 20)

Pipe Bedding and Pipe Zone Backfill Material:

COMPACTED TO 95% OF ASTM D-1557-91 RECOMMENDED GRADATION - SEE SPEC.

1/2" 100% PASSING
 #200 0% - 10% PASSING

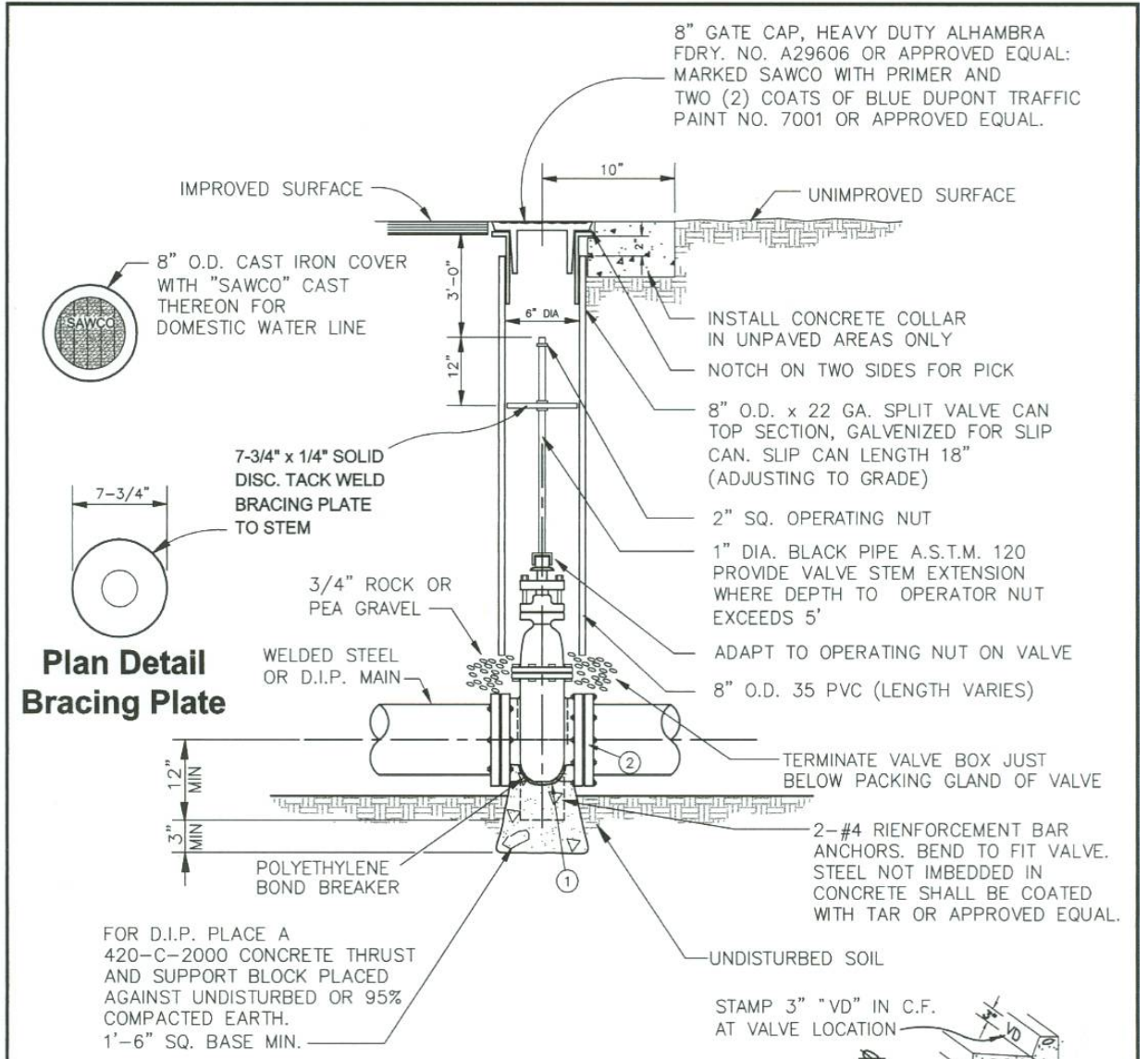
(SE ≥ 20 IF FLOODING OR JETTING IS USED)



TYPICAL EXCAVATION BACKFILL SCHEMATIC

APPROVED BY GENERAL MANAGER
Ray Wellington
 RAY WELLINGTON
 STANDARD DRAWING No.
 SAWCO-4
 REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS



Note

- CONTRACTOR SHALL STAMP A 3" TALL "V" AND THE DISTANCE "D" FROM THE CURB FACE TO THE CENTER OF THE VALVE CAN.

ITEM	DESCRIPTION	APPROVED MATERIAL LIST NO.
①	FLANGED OR MECHANICAL JOINT RESILIENT-SEATED GATE VALVE WITH 2" OPERATING NUT.	2-G.1
②	HEX HEAD BOLTS.	7-E.2



GATE VALVE INSTALLATION

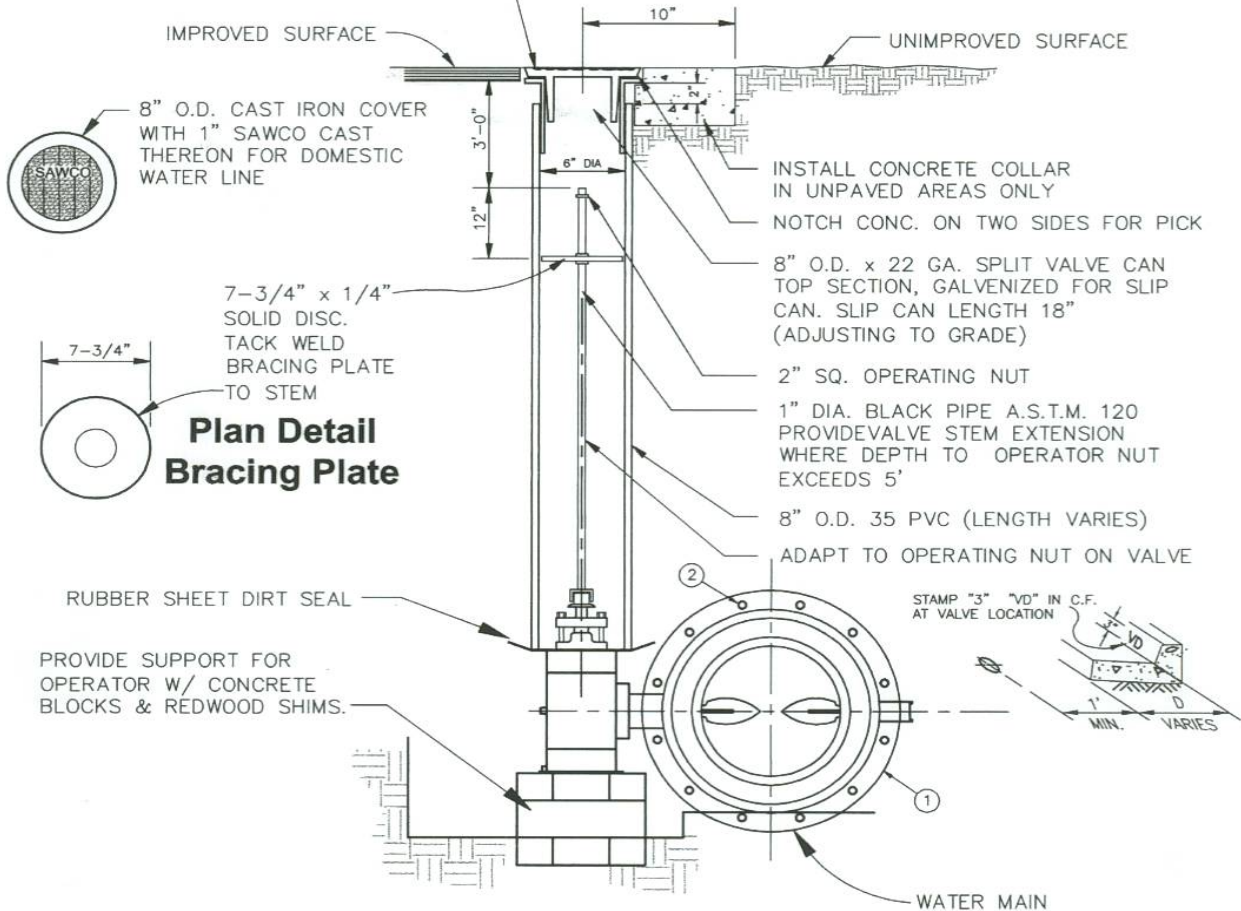
APPROVED BY GENERAL MANAGER
Ray Wellington
 RAY WELLINGTON

STANDARD DRAWING No.
SAWCO-5

REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS

8" GATE CAP, HEAVY DUTY ALHAMBRA FDY. NO. A29606 OR APPROVED EQUAL:
 MARKED SAWCO WATER WITH PRIMER AND TWO (2) COATS OF BLUE DUPONT TRAFFIC
 PAINT NO. 7001 OR APPROVED EQUAL.



Note

1. CONTRACTOR SHALL STAMP A 3" TALL "V" AND THE DISTANCE "D" FROM THE CURB FACE TO THE CENTER OF THE VALVE CAN.
2. BUTTERFLY VALVE ACTUATORS TO BE ON THE LEFT SIDE, WHEN VIEWED FROM THE FITTING THROUGH THE VALVE.

ITEM	DESCRIPTION	APPROVED MATERIAL LIST NO.
①	FLANGED BUTTERFLY VALVE.	2-F
②	HEX HEAD BOLTS	7-E.2

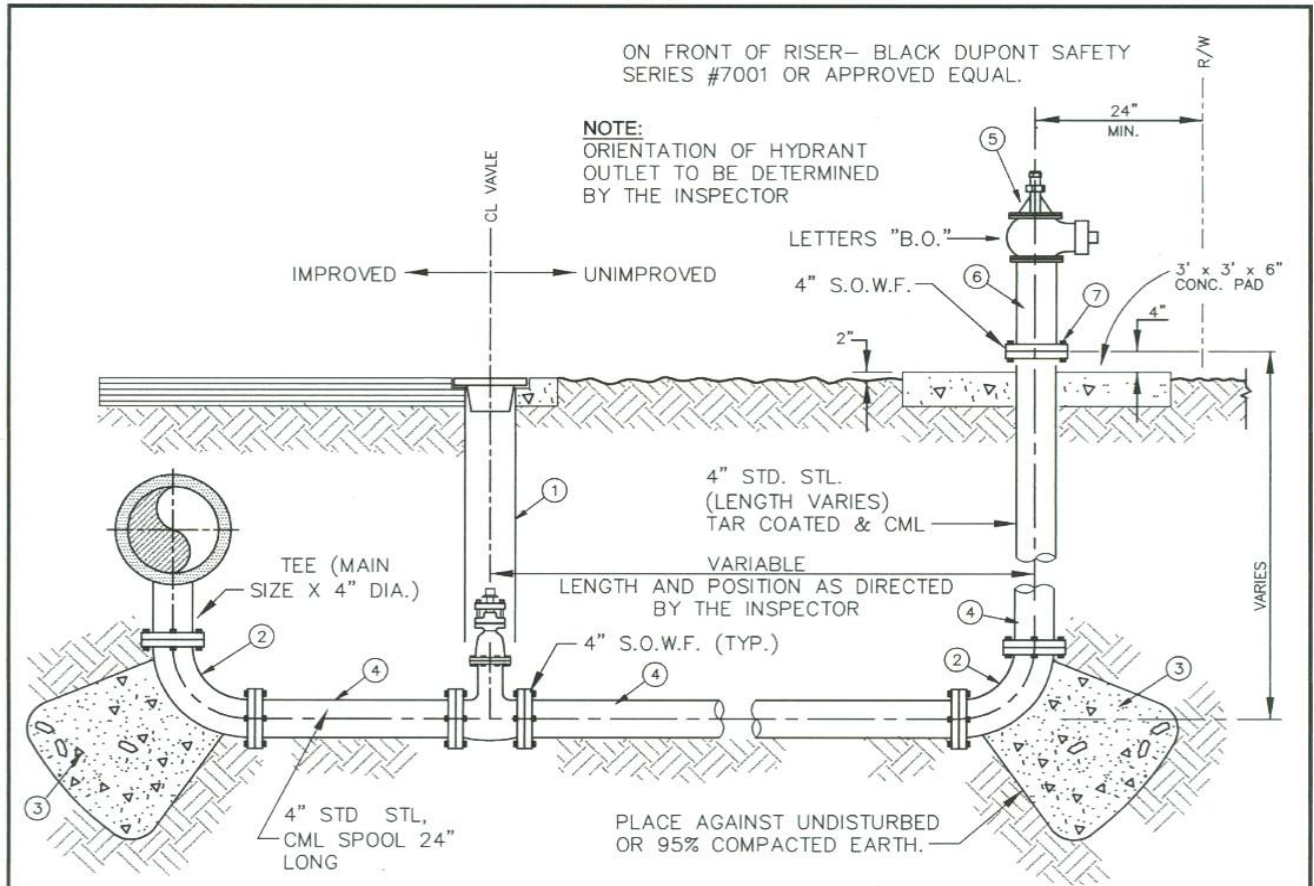


BUTTERFLY VALVE INSTALLATION

APPROVED BY GENERAL MANAGER

 RAY WELLINGTON
 STANDARD DRAWING No.
SAWCO-6
 REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS



ON FRONT OF RISER— BLACK DUPONT SAFETY SERIES #7001 OR APPROVED EQUAL.

NOTE:
ORIENTATION OF HYDRANT
OUTLET TO BE DETERMINED
BY THE INSPECTOR

Notes

1. ALL BLOW-OFFS SHALL HAVE GUARD POSTS, SIZE AND PLACEMENT DETERMINED BY SAWCO.
2. ALL EXPOSED COMPONENTS TO BE PAINTED WITH PRIMER AND TWO COATS OF YELLOW DUPONT SAFETY SERIES #7001 OR APPROVED EQUAL (NO PRIMER ON BRASS OR BRONZE).
3. ALL BURIED STEEL TO BE TAR COATED & CML
4. SEE STANDARD DRAWING SAWCO-15 FOR BLOW-OFF LOCATION WHEN SIDEWALK EXISTS.

ITEM	DESCRIPTION	APPROVED MATERIAL LIST NO.
1	4" DIA. GATE VALVE INSTALLATION PER STD. DWG. SAWCO-5.	SEE SAWCO-5
2	4" STD. 90° FLANGED ELBOW, LINED AND COATED SAME AS MAIN.	5-D
3	THRUST BLOCK PER STD. DWG. SAWCO-13.	SEE SAWCO-13
4	4" STEEL OR DIP PIPE, 10 GA. OR CLASS 350	1-B OR 1-D
5	4" x 2-1/2" BRONZE WHARF HYDRANT	3-B
6	4" STD. STEEL PIPE, STL. CEMENT LINED AND PAINTED, STANDARD WEIGHT	1-D
7	BREAKAWAY BOLTS	7-E.1



4" DIAMETER BLOW-OFF INSTALLATION FOR 12" OR LESS WATERMAIN

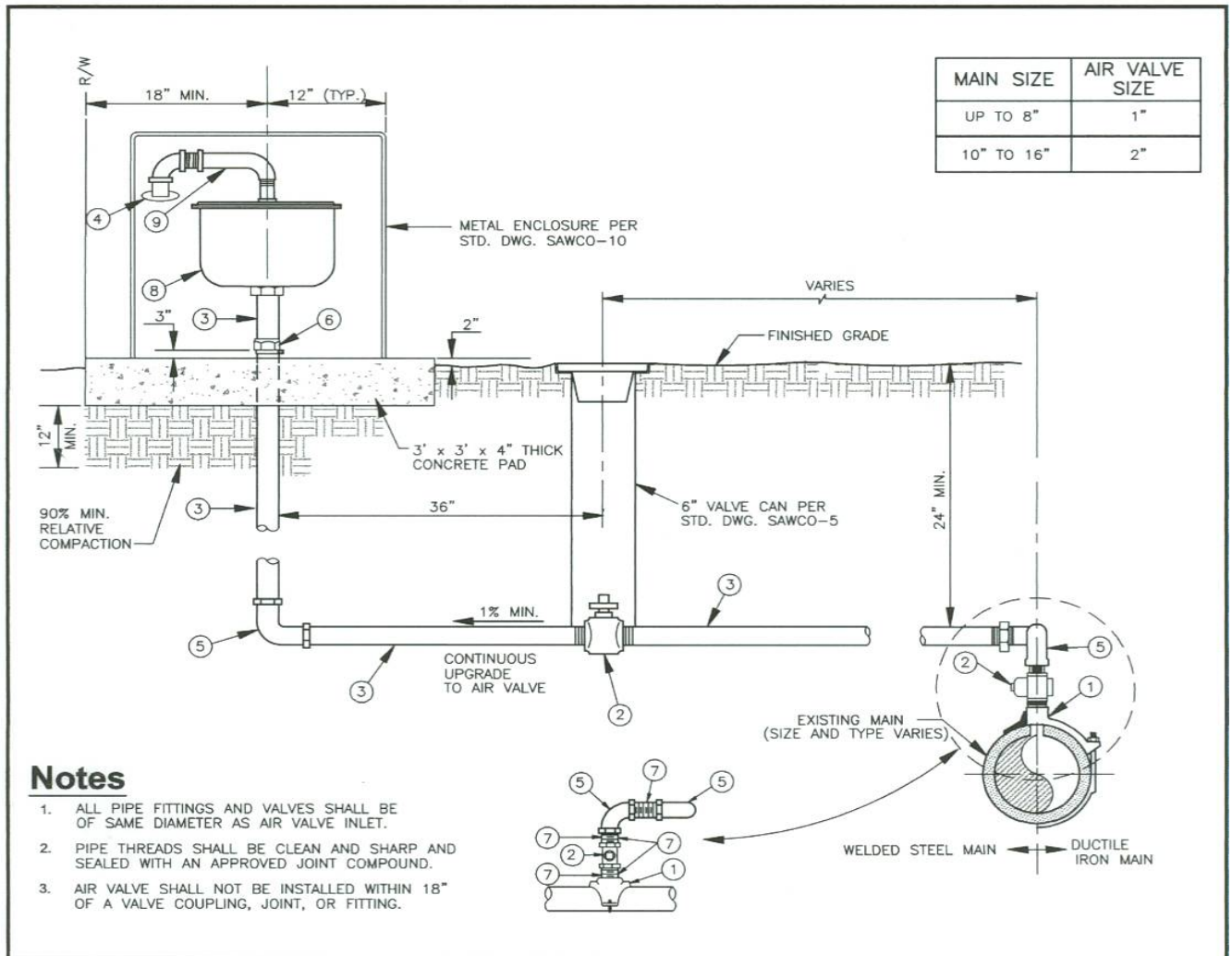
APPROVED BY GENERAL MANAGER

Ray Wellington
RAY WELLINGTON

STANDARD DRAWING No.
SAWCO-8

REVISED DATE: 06-00

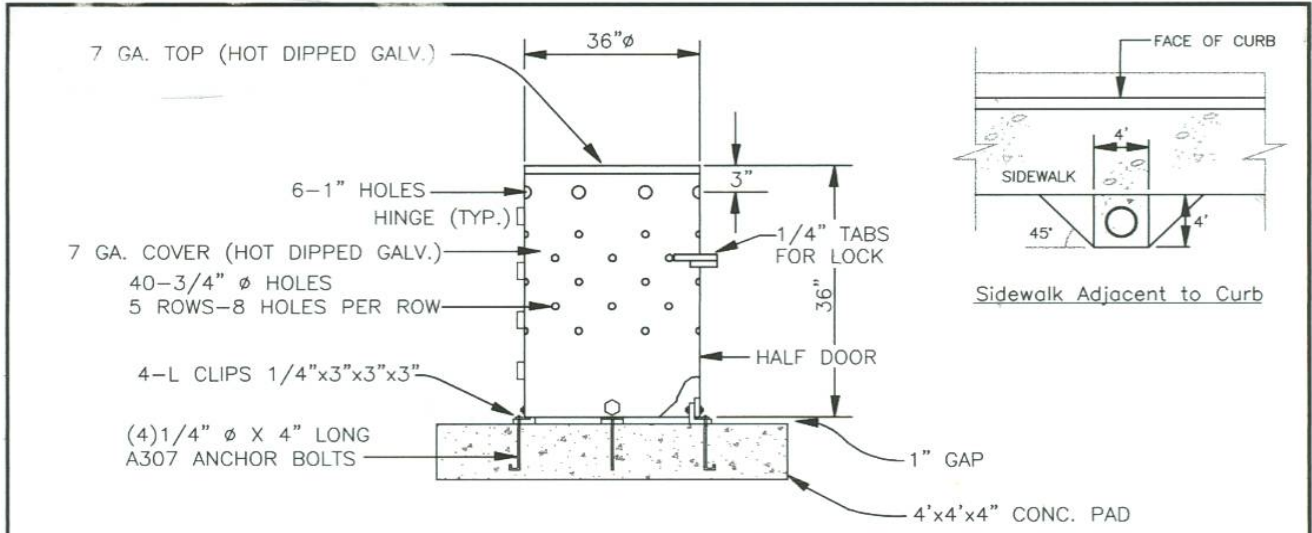
STANDARD DRAWINGS AND DETAILS



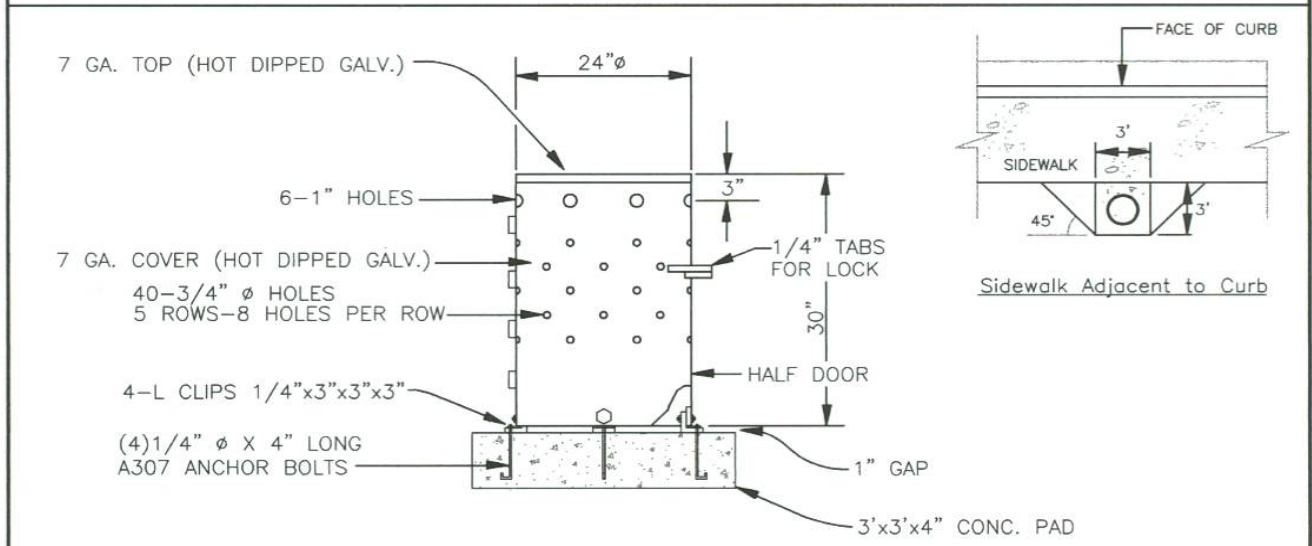
ITEM	DESCRIPTION	APPROVED MATERIAL LIST NO.
①	DOUBLE STRAP BRASS SERVICE SADDLE 1" OR 2" 1" OR 2" STEEL COUPLING. STANDARD WEIGHT	7-H 5-D
②	1" OR 2" GATE VALVE	2-G.2
③	1" OR 2" G.I.P.	1-C
④	AIR-VALVE SCREEN	7-A.1 OR 7-A.2
⑤	1" G.I.P. 90° ELBOWS THREADED	5-C
⑥	G.I.P. COUPLING	5-C
⑦	1" OR 2" G.I.P. THREADED NIPPLE	5-C
⑧	1" OR 2" AIR RELEASE VALVE	2-A OR 2-B
⑨	STANDARD GALV. 90° ST. ELBOW; 3 INCH LONG GALV. NIPPLE; STANDARD GALV. 90° ELBOW; AND 3 INCH STANDARD GALV. NIPPLE. ORIENTED TO CLEAR AIR VALVE BODY.	1-C

	<h2 style="margin: 0;">AIR VALVE INSTALLATION</h2> <h3 style="margin: 0;">1" OR 2" DIAMETER</h3>	APPROVED BY GENERAL MANAGER RAY WELLINGTON
	STANDARD DRAWING No. <h2 style="margin: 0;">SAWCO-9</h2>	
	REVISED DATE: 06-00	

STANDARD DRAWINGS AND DETAILS



4" Dia. Air Valve Enclosure
(Pipeline Products No.VC-330-D)



1" or 2" Dia. Air Valve Enclosure
(Pipeline Products No. VC-324-D)

Notes:

1. GUARD POST SHALL BE PLACED AS SPECIFIED ON THE CONSTRUCTION DRAWINGS IN COMPLIANCE WITH STANDARD DRAWING SAWCO-17.
2. ENCLOSURE INTERIOR & EXTERIOR SHALL BE PAINTED WITH PRIMER AND TWO (2) COATS OF YELLOW DUPONT PAINT #7001 OR APPROVE EQUAL. FINAL DRY FILM THICKNESS SHALL BE 8 MILS. MINIMUM.
3. ENCLOSURE SHALL BE MANUFACTURED BY PIPELINE PRODUCTS (800-998-1079) OR APPROVED EQUAL.
4. AIR VALVE MAY ENCR OACH INTO SIDEWALK IF A FOUR FOOT MINIMUM WIDTH IS MAINTAINED.



AIR VALVE ENCLOSURES

APPROVED BY GENERAL MANAGER

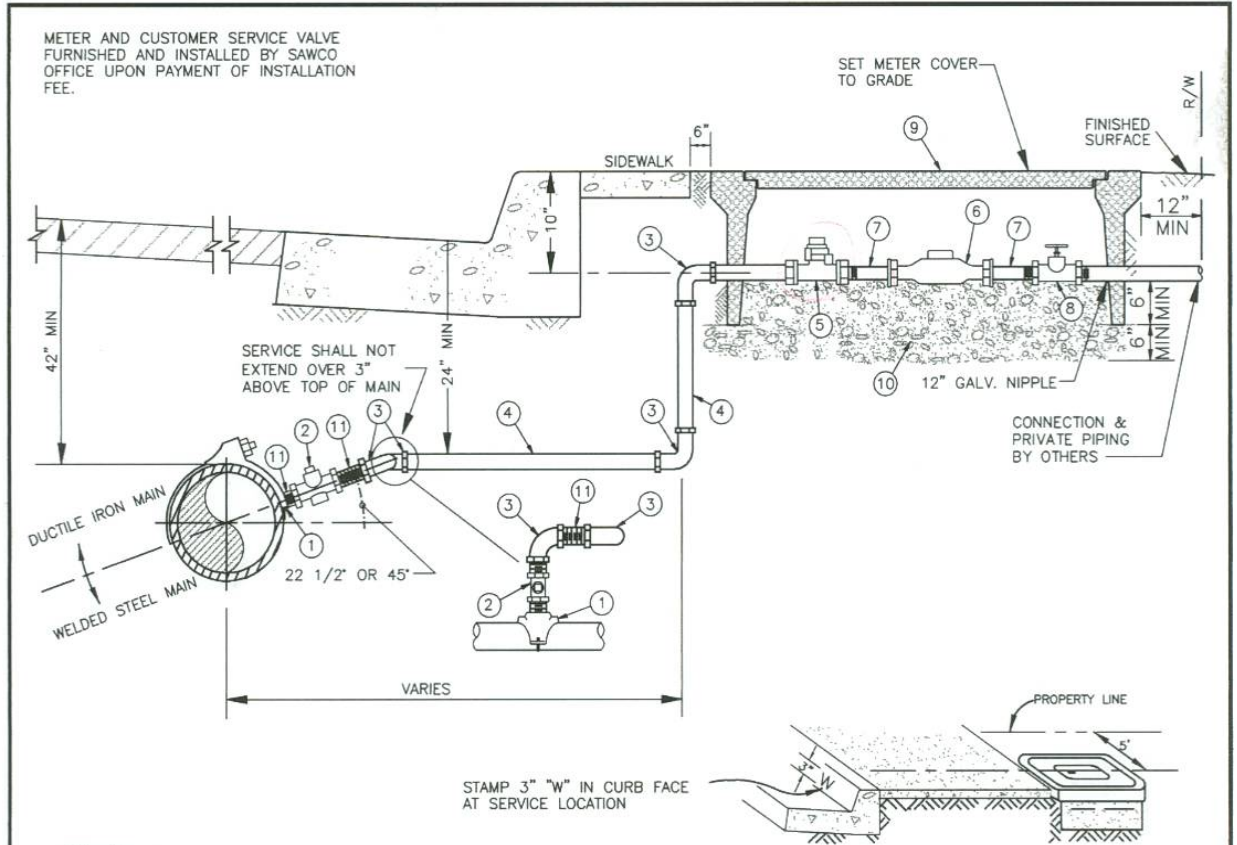
Ray Wellington
RAY WELLINGTON

STANDARD DRAWING No.

SAWCO-10

REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS



Notes

1. PIPE THREADS SHALL BE CLEAN, SHARP AND SEALED WITH AN APPROVED JOINT COMPOUND
2. WATER METER BOX AND COVER SHALL BE NEW FOR METER RELOCATION WORK.
3. PROVIDE BRASS BUSHINGS FOR 5/8" x 3/4" AND 3/4" METER INSTALLATIONS.

ITEM	DESCRIPTION	APPROVED MATERIAL LIST NO.
(1)	<i>MALLEABLE IRON</i> DOUBLE STRAP-BRASS-SERVICE 1" I.P. OUTLET OR 1" STEEL COUPLING, STANDARD WEIGHT	7-H, 5-D
(2)	1" GATE VALVE	2-G.2
(3)	1" 90° ELBOW, STANDARD WEIGHT	5-C
(4)	1" PIPE, STANDARD WEIGHT	1-C
(5)	1" CURB STOP, BRASS	2-D
(6)	5/8" x 3/4" METER, BRONZE, (FURNISHED BY SAWCO), 3/4" METER, BRONZE, (FURNISHED BY SAWCO), OR 1" METER, BRONZE, (FURNISHED BY SAWCO)	7-D.1, 7-D.2, 7-D.3
(7)	3/4" OR 1" STRAIGHT METER COUPLING	7-J
(8)	1" GATE VALVE, BRONZE (FIPTxFIPT)	2-G.4
(9)	PLASTIC METER BOX WITH T-COVER	6-B.1
(10)	3/4" ROCK BASE. 12" THICK	N/A
(11)	1" THREADED NIPPLE, STANDARD WEIGHT	5-C



TYPICAL SERVICE INSTALLATION FOR 5/8" x 3/4", 3/4", & 1" METERS

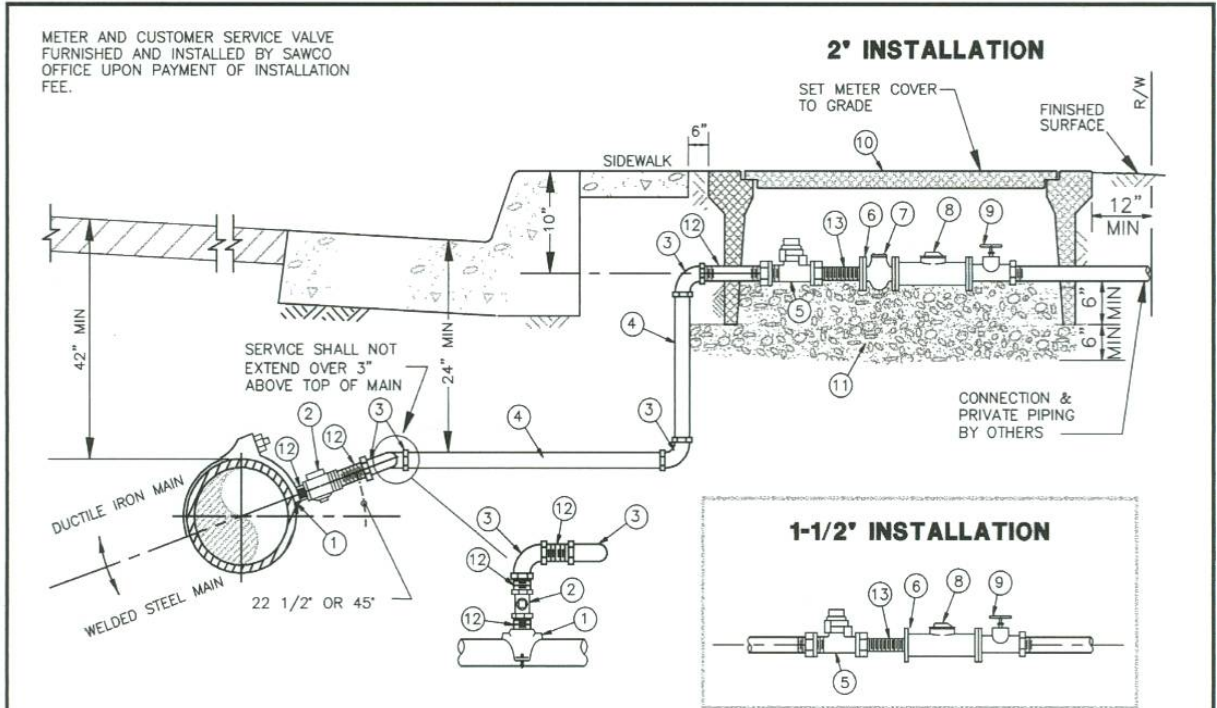
APPROVED BY GENERAL MANAGER

Ray Wellington
RAY WELLINGTON

STANDARD DRAWING No.
SAWCO-11

REVISED DATE: 06-00

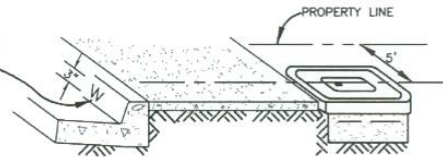
STANDARD DRAWINGS AND DETAILS



Notes

1. PIPE THREADS SHALL BE CLEAN, SHARP AND SEALED WITH AN APPROVED JOINT COMPOUND.
2. WATER METER BOX AND COVER SHALL BE NEW FOR METER RELOCATION WORK.
3. STRAINER ON 2" METER INSTALLATIONS ONLY.

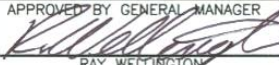
STAMP 3" "W" IN CURB FACE AT SERVICE LOCATION



ITEM	DESCRIPTION	APPROVED MATERIAL LIST NO.
①	DOUBLE STRAP BRASS SERVICE 1 1/2" OR 2" IRON PIPE OUTLET OR 1 1/2" OR 2" STEEL COUPLING, STANDARD WEIGHT	7-H.1 OR 5-D
②	1 1/2" OR 2" GATE VALVE	2-G.2
③	1 1/2" OR 2" 90° ELBOW, STANDARD WEIGHT	5-C
④	1 1/2" OR 2" PIPE, STANDARD WEIGHT	1-C
⑤	1 1/2" OR 2" CURB STOP, BRASS	2-C OR 2-E
⑥	1 1/2" OR 2" WATER METER FLANGE, BRONZE	7-B
⑦	STRAINER, (NOT REQUIRED WITH 1 1/2" INSTALLATION)	7-I
⑧	1 1/2" OR 2" NEPTUNE TURBINE METER, FLANGED (FURNISHED BY SAWCO)	7-D.4 OR 7-D.5
⑨	1 1/2" OR 2" GATE VALVE - BRONZE	2-G.3
⑩	PLASTIC METER BOX	6-B.2
⑪	3/4" ROCK BASE. 12" THICK	N/A
⑫	1 1/2" OR 2" NIPPLE, GALVANIZED	5-C
⑬	1 1/2" OR 2" CLOSE NIPPLE, BRASS	5-A

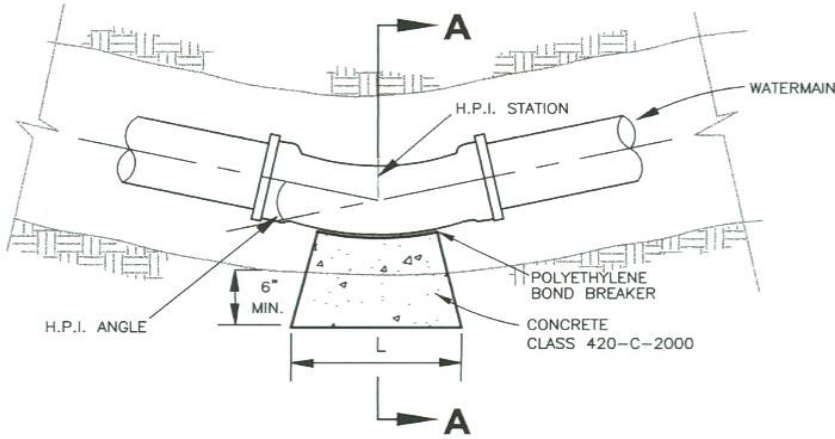


TYPICAL SERVICE INSTALLATION FOR 1 1/2" & 2" METERS

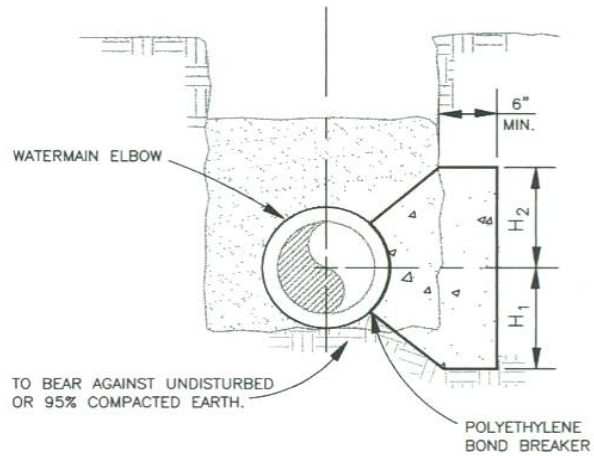
APPROVED BY GENERAL MANAGER

 RAY WELLINGTON
 STANDARD DRAWING No.
SAWCO-12
 REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS

HORIZONTAL BEND THRUST BLOCK



SECTIONAL PLAN



TO BEAR AGAINST UNDISTURBED OR 95% COMPACTED EARTH.

SECTION A-A

PIPE DIA.	H ₁	H ₂	L	H.P.I. ANGLE
4"	1/2 O.D.	1/2 O.D.	4'-0"	5° TO 41°
4"	4"	4"	4'-0"	42° TO 83°
4"	10"	5"	4'-0"	84° TO 104°
6"	1/2 O.D.	1/2 O.D.	4'-0"	5° TO 27°
6"	6"	6"	4'-0"	28° TO 51°
6"	1'-5"	9"	4'-0"	52° TO 90°
8"	1/2 O.D.	1/2 O.D.	4'-0"	5° TO 20°
8"	8"	8"	4'-0"	21° TO 36°
8"	1'-6"	10"	4'-0"	37° TO 54°
8"	2'-2"	1'-1"	4'-0"	55° TO 78°
8"	2'-8"	1'-4"	4'-0"	79° TO 111°
10"	1/2 O.D.	1/2 O.D.	4'-0"	5° TO 16°
10"	10"	10"	4'-0"	17° TO 28°
10"	1'-10"	11"	4'-0"	29° TO 39°
10"	2'-4"	1'-2"	4'-0"	40° TO 53°
10"	2'-10"	1'-6"	4'-0"	54° TO 70°
10"	2'-10"	1'-6"	6'-0"	71° TO 120°
12"	1/2 O.D.	1/2 O.D.	4'-0"	5° TO 13°
12"	12"	12"	4'-0"	14° TO 22°
12"	2'-0"	12"	4'-0"	23° TO 30°
12"	2'-6"	1'-3"	4'-0"	31° TO 40°
12"	3'-0"	1'-6"	4'-0"	41° TO 52°
12"	3'-0"	1'-6"	6'-0"	53° TO 83°

Notes

- PIPE INSTALLED UNDER CONDITIONS DIFFERENT FROM THOSE NORMALLY ENCOUNTERED SHALL REQUIRE THRUST BLOCKS DESIGNED FOR THOSE PARTICULAR CONDITIONS.
- ALL THRUST BLOCKS SHALL BE 420-C-2000 CONCRETE AND PLACE AGAINST UNDISTURBED OR 95% COMPACTED SOIL. SAWCO WILL DETERMINE SIZES NOT SHOWN.
- THRUST BLOCKS ON CROSSES SHALL BE USED WHENEVER PIPE SIZES DIFFER OR WHEN ONE OR MORE OPENINGS ARE PLUGGED.
- REINFORCING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATIONS A15 AND A305 INTERMEDIATE GRADE.
- ALL FITTINGS TO BE WRAPPED WITH POLYETHYLENE.
- VERTICAL THRUST BLOCKS SHALL BE IN COMPLIANCE WITH THE CONSTRUCTION DRAWINGS.

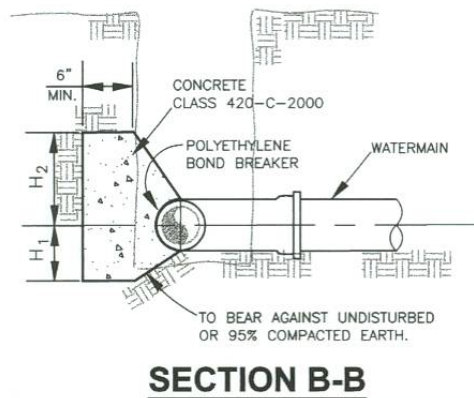
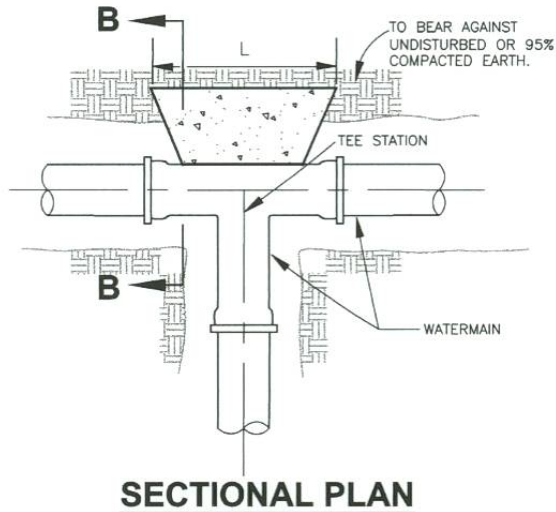


THRUST BLOCKS FOR STEEL AND D.I.P.
PIPELINES, 225 P.S.I. MAX.

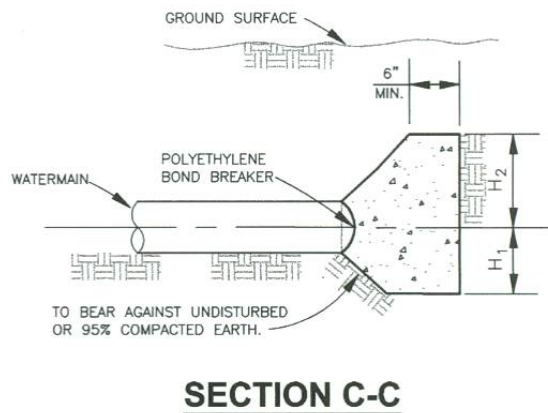
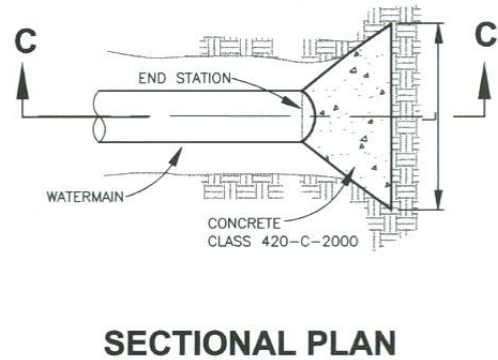
APPROVED BY GENERAL MANAGER
Ray Wellington
RAY WELLINGTON
STANDARD DRAWING No.
SAWCO-13 (1 OF 3)
REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS

TEE THRUST BLOCK



END THRUST BLOCK



Notes

1. PIPE INSTALLED UNDER CONDITIONS DIFFERENT FROM THOSE NORMALLY ENCOUNTERED SHALL REQUIRE THRUST BLOCKS DESIGNED FOR THOSE PARTICULAR CONDITIONS.
2. ALL THRUST BLOCKS SHALL BE 420-C-2000 CONCRETE AND PLACE AGAINST UNDISTURBED OR 95% COMPACTED SOIL. SAWCO WILL DETERMINE SIZES NOT SHOWN.
3. THRUST BLOCKS ON CROSSES SHALL BE USED WHENEVER PIPE SIZES DIFFER OR WHEN ONE OR MORE OPENINGS ARE PLUGGED.
4. REINFORCING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATIONS A15 AND A305 INTERMEDIATE GRADE.
5. ALL FITTINGS TO BE WRAPPED WITH POLYETHYLENE.
6. VERTICAL THRUST BLOCKS SHALL BE IN COMPLIANCE WITH THE CONSTRUCTION DRAWINGS.

*PIPE DIA.	H ₁	H ₂	L
4"	9"	6"	3'-6"
6"	1'-6"	9"	4'-0"
8"	2'-2"	1'-1"	4'-0"
10"	2'-10"	1'-5"	4'-0"
12"	3'-0"	1'-6"	5'-0"

* USE OUTLET PIPE DIAMETER



THRUST BLOCKS FOR STEEL AND D.I.P.
PIPELINES, 225 P.S.I. MAX.

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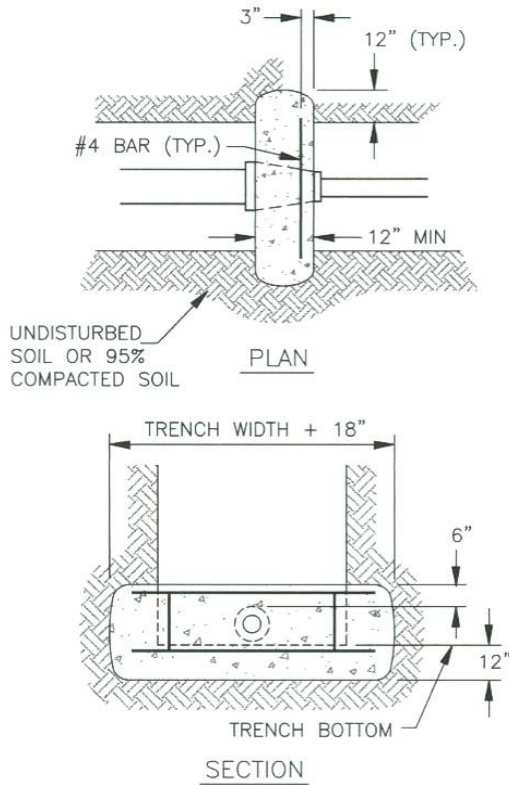
STANDARD DRAWING No.

SAWCO-13 (2 OF 3)

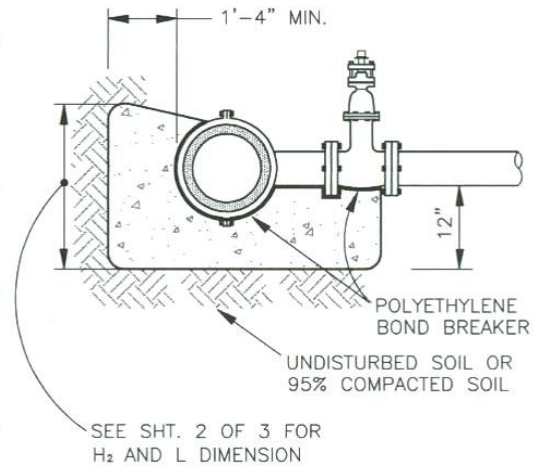
REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS

REDUCER THRUST BLOCK



HOT TAP THRUST BLOCK



Notes

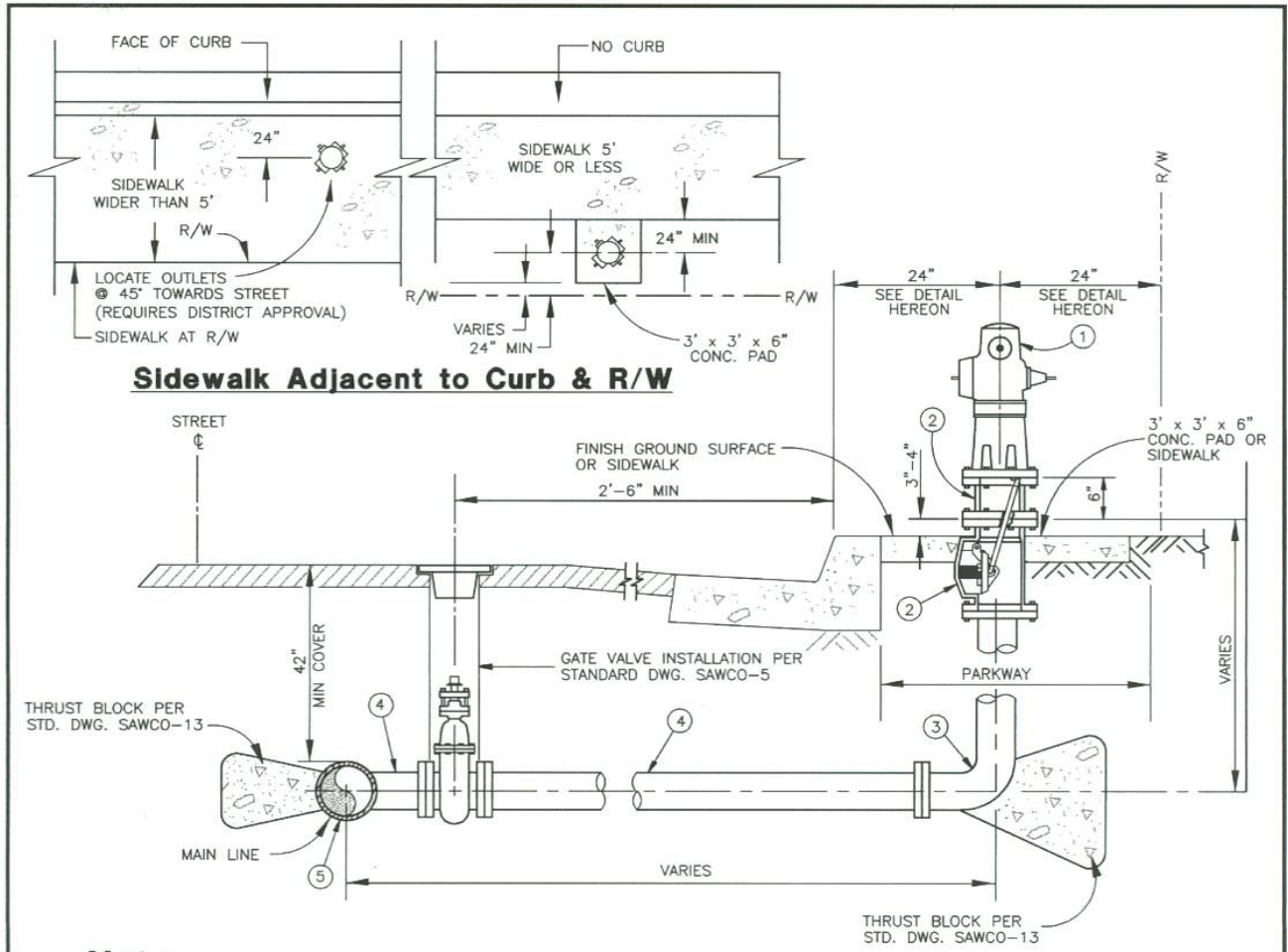
1. PIPE INSTALLED UNDER CONDITIONS DIFFERENT FROM THOSE NORMALLY ENCOUNTERED SHALL REQUIRE THRUST BLOCKS DESIGNED FOR THOSE PARTICULAR CONDITIONS.
2. ALL THRUST BLOCKS SHALL BE 420-C-2000 CONCRETE AND PLACE AGAINST UNDISTURBED OR 95% COMPACTED SOIL. SAWCO WILL DETERMINE SIZES NOT SHOWN.
3. THRUST BLOCKS ON CROSSES SHALL BE USED WHENEVER PIPE SIZES DIFFER OR WHEN ONE OR MORE OPENINGS ARE PLUGGED.
4. REINFORCING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATIONS A15 AND A305 INTERMEDIATE GRADE.
5. ALL FITTINGS TO BE WRAPPED WITH POLYETHYLENE.



THRUST BLOCKS FOR STEEL AND D.I.P.
PIPELINES, 225 P.S.I. MAX.

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STANDARD DRAWING No.
SAWCO-13 (3 OF 3)
REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS



Sidewalk Adjacent to Curb & R/W

Notes

1. NORMAL LOCATION WATER HYDRANT IS 2'-0" AWAY FROM FACE OF CURB WHEN SIDEWALK IS AT PROPERTY LINE. IF THERE IS NO CURB LOCATE WATER HYDRANT 2'-0" FROM PROPERTY LINE.
2. WATER HYDRANTS IN UNPAVED ROAD SHALL HAVE GUARD POSTS, SIZE AND PLACEMENT DETERMINED BY SAWCO.
3. A CONCRETE PAD OF 3' x 3' x 6" MUST BE PROVIDED WHEN THE HYDRANT IS LOCATED OUTSIDE OF A SIDEWALK.
4. WRAP 8 MIL POLYETHYLENE AROUND PARTS REQUIRING THRUST BLOCKS.

ITEM	QTY	DESCRIPTION	APPROVED MATERIAL LIST NO.
①		6" x 2- 1/2" x 4" FIRE HYDRANT HEAD, 6 HOLE BOLT PATTERN.	3-A
②		BREAK-OFF CHECK VALVE , 6 HOLE BOLT PATTERN	3-C & 7-E.2
③		FLANGED x MECHANICAL JOINT BURY, DUCTILE IRON (CLASS 350) OR FLANGE x FLANGE BURY, CMC & C, STEEL (STANDARD WEIGHT)	5-B OR 5-D
④		DUCTILE IRON CLASS 350, CML & TAR COATED, OR CML & C STEEL, STANDARD WEIGHT.	1-B OR 1-D
⑤		MAIN SIZE x 6" FLANGED, OR MECHANICAL JOINT x FLANGE, DUCTILE IRON TEE	5-B.1, 5-B.2



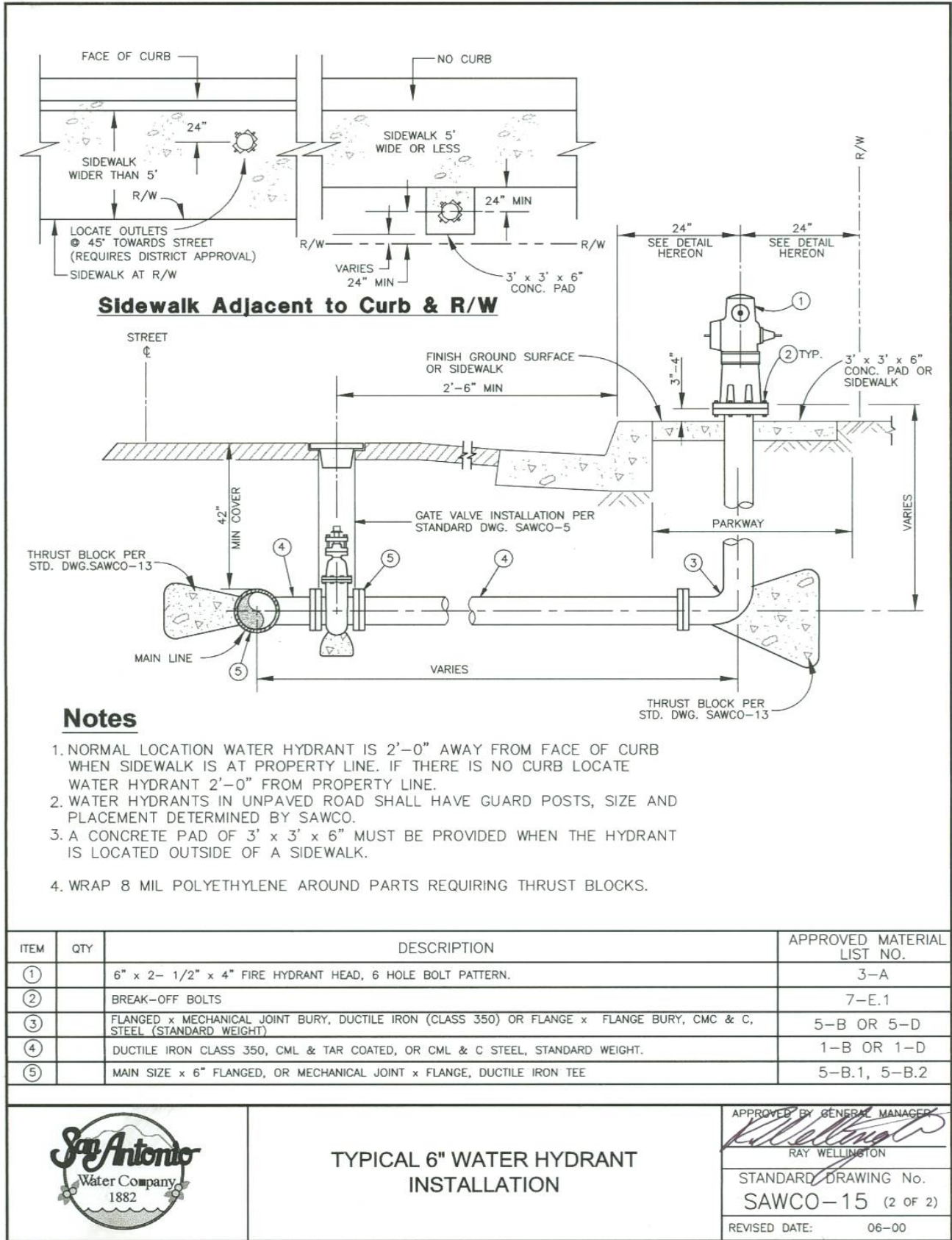
TYPICAL 6" WATER HYDRANT INSTALLATION WITH BREAK-OFF CHECK VALVE ASSEMBLY

APPROVED BY GENERAL MANAGER
Ray Wellington
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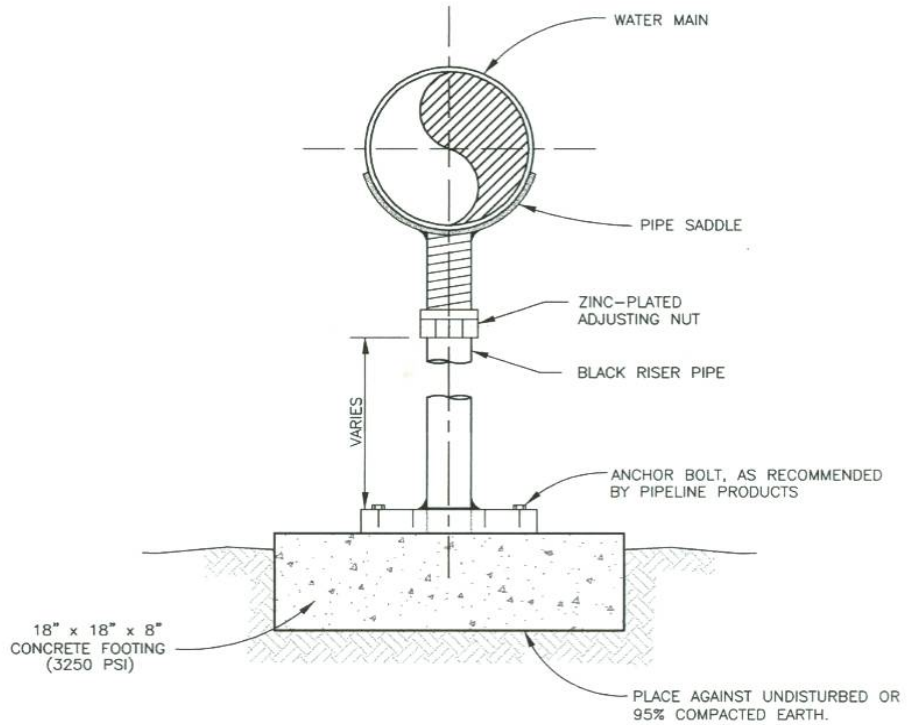
STANDARD DRAWING No.
SAWCO-15 (1 OF 2)

REVISED DATE: 06-00

STANDARD DRAWINGS AND DETAILS



STANDARD DRAWINGS AND DETAILS



DIA.	MAX SPACING
2" & LESS	8'
4" - 24"	10'

Notes

1. PIPE SUPPORT SHALL BE MANUFACTURED BY PIPELINE PRODUCTS.
2. RISER PIPE AND BASE FLANGE SHALL BE AS RECOMMENDED BY PIPELINE PRODUCTS.
3. PIPE SUPPORT LOCATIONS SHALL BE IN COMPLIANCE WITH THE CONSTRUCTION DRAWINGS BUT SHALL NOT EXCEED THE MAXIMUM SPACING REQUIREMENTS.



PIPE SUPPORT DETAIL
PIPELINE PRODUCTS

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Ray Wellington
RAY WELLINGTON
STANDARD DRAWING No.
SAWCO-18
REVISED DATE: 06-00