CITY OF VISALIA

PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

STANDARD SPECIFICATIONS

March 2008

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CITY OF VISALIA
ENGINEERING DIVISION
315 EAST ACEQUIA AVENUE
VISALIA, CA 93291

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PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

STANDARD SPECIFICATIONS

The City of Visalia Engineering Division has recently revised and updated this set of Standard Specifications. These Standard Specifications have been used as accepted standards for subdivisions, and other building, public works and parks projects. These Standard Specifications and Engineering Improvement Standards will be considered for updates as practices and materials change; and these updates will occur on an as needed basis and approved by the City Engineer, but at a minimum every two (2) years; and these updates will be automatically incorporated as part of the whole Standard Specifications.

Approved by: _____ R.C.E. 50022
Public Works Director

March 2008

CITY OF VISALIA
ENGINEERING DIVISION
315 EAST ACEQUIA AVENUE
VISALIA, CA 93291

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SECTION 1 - DEFINITIONS AND TERMS

1.01 GENERAL

Wherever in these Standard Specifications or the State of California Standard Specifications and other contract documents the abbreviations and terms, or pronouns in place of them, are used, the intent and meaning shall be interpreted as provided in Section 1 of the State of California Department of Transportation Standard Specifications, latest edition, or as modified in these Standard Specifications.

1.02 DEFINITIONS AND TERMS

The definitions and terms as used in these Standard Specifications and the State of California Standard Specifications shall be interpreted and understood as established in Section 1 of the State of California Standard Specifications except as modified herein:

a. Addenda: Written interpretations or revisions to any of the contract documents issued by the City before the bid opening.

b. Bid: The proposal submitted by the Contractor in response to the invitation to bid made by the City.

c. Bidder: Any individual, firm, partnership, corporation, or combination thereof, submitting a proposal for the work contemplated, acting directly through a duly authorized representative.

d. Certified Testing Laboratory: An established laboratory properly certified and approved by the Director of Public Works to test materials, specimen, or work involved in the contract, and as specified herein.

e. Change Order: An order approved by the Engineer and issued to the Contractor amending the contract documents.

f. City: The City of Visalia, California, as represented by the City Engineer.

g. City Clerk: The legally authorized City Clerk of the City of Visalia, California.

h. City Council: The City Council of the City of Visalia, California.

i. City Specifications: City of Visalia, California, Department of Public Works Standard Specifications, as amended from time to time.

j. City Standard Drawings: City of Visalia, Department of Public Works Improvement Standards, as amended from time to time.

k. Contract Documents: The Contract Documents include without limitation, the Construction Agreement, Plan, Specifications, Contract Bonds, Addenda to the Construction Agreement, and Change Orders.

l. Contractor: The person or persons, firm, partnership, corporation or combination thereof, private or municipal, who have entered into a contract with the City or a

developer, as party or parties of the second part or his or their legal representative.

m. Department or Department of Transportation: The Department of Public Works, City of Visalia, California.

n. Developer: An individual or group proposing to subdivide or improve land within the City and constructing or causing to be constructed improvements to be accepted by the City.

o. Engineer: The Engineer of the City of Visalia, California, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties delegated to them.

p. Finished Grade: The top of the surface layer of asphalt and/or concrete upon which vehicles travel and/or park.

q. Laboratory: See "Certified Testing Laboratory".

r. Plans: The official plans, profiles, typical cross-sections, general cross-sections, elevations and details which show the locations, character, dimensions and details of the work to be performed.

s. Special Provisions: Specific Clauses setting forth conditions or requirements peculiar to the work and supplementary to the City Specifications.

t. Specifications: A set of documents issued for the intended work which includes the City Specifications, the Special Provisions, Notice to Contractors, Proposal, and Contract Form.

u. Standard Plans: The Engineering Improvement Standards of the Public Works Department of the City of Visalia, California.

v. Standard Specifications: The Standard Specifications of the City of Visalia, as prepared by the Engineering Division of the City of Visalia, California.

w. State of California Standard Specifications: The latest revision of the Standard Specifications issued by the Department of Transportation (Caltrans) of the Business, Transportation and Housing Agency of the State of California. Sections 10 through 60, inclusive, Section 73 and Sections 92 through 94, inclusive, of said standard specifications are hereby incorporated and included in the Standard Specifications of the City of Visalia, California, except as modified by said City of Visalia Standard Specifications. Other sections of the State of California Standard Specifications are included in the Standard Specifications of the City of Visalia, California, by reference either in these Standard Specifications, the Special Provisions; or in the Standard Specifications of the State of California.

x. State: California.

y. State Standard Plans: State of California, Department of Transportation Standard Plans, being the current issue in use by the State.

z. Subgrade: The level of embankment, native material and/or import upon which the first layer of street structural section (either aggregate, subbase, aggregate base lime treated or cement treated base [plant mixed], or asphalt concrete is placed).

aa. Working Days: Unless otherwise designated, working day as used in these Standard Specifications shall mean any day on which the Contractor is not prevented by inclement weather, or conditions resulting there, from proceeding with substantial prosecution of the work, excluding Saturdays, Sundays, legal holidays, and any other day the Contractor is specifically required by the Special Provisions to suspend construction operations.

SECTION 2 - PROPOSAL REQUIREMENTS

2.01 GENERAL INFORMATION

The City Engineer of the City of Visalia, California, will receive at his/her office at City Hall East, in said City, until the hour and day specified in the "Notice to Contractor," sealed proposals, for furnishing material, supplies, equipment and labor for performing the work as specified in the approved Construction Drawings, these Standard Specifications and the Special Provisions.

2.02 ENGINEER'S ESTIMATE

The items of work given in the Bid Proposal and in these Standard Specifications are given as a basis for comparison of bids and the City does not expressly or by implication agree that the actual amount of work will correspond therewith, and reserves the right to increase or decrease the amount of the work or to omit portions of the work as may be deemed advisable by the Engineer. All bids are to be compared on the basis of the City Engineer's estimate of the quantities of work to be done.

2.03 UNIT PRICES

Except the items for which lump sums are called for, the unit prices inserted in the bid form by the bidder will be considered to be the bid prices for the various work performed. In case of a discrepancy between the unit price bid and the calculated total, the unit price will govern, and the total will be recalculated. In the event of discrepancy between numbers and written prices, the written prices will govern.

2.04 EXAMINATION OF SITE OF WORK, PLANS, SPECIFICATIONS AND CONTRACT FORM

The Bidder is required to examine carefully the site of the proposed work, the proposal, approved Construction Drawings, specifications and contract forms for the work contemplated, and 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 the work to be performed and materials to be furnished, and as to the requirements of the specifications, and the contract. The submission of a proposal shall be considered prima facie evidence that the Bidder has made such examination. A representative from the City Engineer's office will be available to accompany prospective bidders for an inspection of the work herein contemplated.

2.05 FORM OF PROPOSAL

All proposals must be made upon blank forms to be obtained from the City Engineer. All proposals must give the unit price where indicated, or lump sum where unit prices are not called for, for each of the items, and must be signed by the bidder with his address. If the proposal is made by an individual, his name and post office address must be shown. If made by a partnership, the name and post office address of each member of the firm or partnership must be shown. If made by a corporation, the proposal must show the name of the State under

the laws of which the corporation was chartered and the names, titles and business addresses of the president, secretary and treasurer.

All proposals must be submitted under sealed cover and the envelope properly marked "Bid (*Insert Project Title*) ."

2.06 WITHDRAWAL OF PROPOSALS

Any bid may be withdrawn at any time prior to the time fixed in the "Notice to Contractors" for the opening of bids only upon written request for the withdrawal of the bid filed with the City. The request shall be executed by the Bidder or his duly authorized representative. The withdrawal of a bid does not prejudice the right of the Bidder to file a new bid. A bid will not be received after the time, nor any bid withdrawn after the time fixed in the public notice for the opening of bids until either all bids are rejected, or until the expiration of sixty (60) days set from the date set for the opening of bids, or until the contract has been executed and the required Contractor's bonds furnished by the successful Bidder or Bidders, whichever occurs first.

2.07 PROPOSAL GUARANTEE

All proposals must be accompanied by either a cashier's check, certified check or bidder's bond of a corporate surety authorized to do business in the State of California and acceptable to the City in a sum equal to at least ten percent (10%) of the total amount of the bid. Checks or bonds must be made payable to the City of Visalia, such securities to be retained by the City as a guarantee that the Bidder, if his bid is accepted, will enter into a satisfactory contract within ten (10) calendar days, not including Sundays and legal holidays, from the date that the "Notice of Award" is mailed to the Bidder, and will furnish a good and sufficient bond for the faithful performance thereof and for the payment of labor and material costs in accordance with the requirements of the approved Construction Drawings, these Standard Specifications and the Special Provisions.

2.08 REJECTION OF PROPOSALS

The City reserves the right to reject any or all proposals.

Proposals may be rejected if they show any alteration of form, additions not called for, conditional or alternative bids, incomplete bids, erasures, or irregularities of any kind. Proposals in which the prices are obviously unbalanced may be rejected.

2.09 DISQUALIFICATION OF BIDDERS

Unless alternate bids are called for, more than one (1) proposal for the same unit or units from an individual, firm, partnership, co-partnership, corporation, or combination thereof under the same or different names will not be considered. If there is reason for believing that collusion exists among the Bidders, none of the participants in such collusion will be considered in future proposals.

2.10 SUBCONTRACTING

Should any Bidder propose subcontracting any part of the work covered by these Standard Specifications, he shall submit with his bid a description of the work to be done by each subcontractor and the name and the location of the place of business of each such subcontractor as a part of the "Bidder's Proposal". The Contractor shall conform to the requirements of Section 8, "Prosecution and Progress" of the State of California Standard Specifications. The Contractor shall perform with his own organization contract work amounting to not less than fifty percent (50%) of the original total contract price. Attention is directed to Section 8.01 of these Standard Specifications.

2.11 GUARANTEE OF WORK

Before any contract is awarded, the Bidder may be required to furnish a complete statement or the origin, composition, and manufacturer of any or all materials to be used in the construction of the work, together with samples, which samples may be subject to the tests provided for in these Standard Specifications to determine their quality and fitness for the work.

The Bidder may also be required to furnish a written guarantee covering certain items of work for varying periods of time from the date of acceptance of the contract. When such guarantee is required, the form and the time limit of the guarantee will be specified in these Standard Specifications or in the Special Provisions. Said guarantee shall be signed and delivered to the Engineer before acceptance of the contract. The Labor and Materials bond shall not be reduced until the expiration of the time required by Section 3249 of the Civil Code.

2.12 CONTRACTOR'S LICENSE

Unless stated otherwise in the "Notice to Contractors," all prospective Bidders must possess, or be able to obtain within thirty (30) days after the bid date, a Class "A" Contractor's License issued by the State of California. All Contractors and/or subcontractors shall be required to obtain a City of Visalia business license. No payment will be made to any Contractor until such license is obtained.

SECTION 3 - AWARD AND EXECUTION OF CONTRACT

3.01 MULTIPLE CONSTRUCTION UNITS

If there are two (2) or more units in the construction project and the "Notice to Contractors" has called for separate proposals for each unit, the City reserves the right to award the contract for one (1) unit or for more than one (1) unit to one (1) Bidder, while awarding a contract or contracts to other Bidders for other units or combinations of units.

3.02 AWARD OF CONTRACT

The award of the contract, if it is awarded, will be to the lowest responsible Bidder whose proposal complies with all the requirements described. Such award, if made, will be made within thirty (30) days after the opening of the proposals. If the lowest responsible Bidder refuses or fails to execute the contract, the City may award the contract to the second lowest responsible bidder. Such award, if made, will be made within forty-five (45) days after the opening of the proposals. If the second lowest responsible Bidder refuses or fails to execute the contract, the Owner may award the contract to the third lowest responsible Bidder. Such award, if made, will be made within sixty (60) days after the opening of the proposals. The periods of time specified above, within which the award of contract may be made, shall be subject to extension for such further periods as may be agreed upon in writing between the Owner and Bidder concerned.

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

3.03 EXECUTION OF CONTRACT

The contract shall be signed by the successful Bidder and returned together with the contract bonds within ten (10) calendar days, not including Sundays and legal holidays, from the date that the "Notice of Award" has been mailed. No proposal shall be considered binding upon the City until execution of the contract.

Failure to execute a contract and file acceptable bonds as provided herein within ten (10) calendar days, after the Bidder has received notice that the contract has been awarded, shall be just cause for the annulment of the award and the forfeiture of the proposal guarantee as liquidated damages.

3.04 RETURN OF GUARANTEES

All proposal guarantees will be held until ten (10) days after the contract has been awarded, after which the guarantees accompanying proposals no longer considered in making the award will be returned to the Bidder whose proposal they accompanies. Retained proposal guarantees will be held until the contract has been executed, after which all guarantees, except those forfeited, will be returned.

3.05 REQUIRED CONTRACT SECURITIES

The Bidder to whom the contract has been awarded will be required to furnish a labor and material bond in an amount equal to fifty percent (50%) of the contract price, and a faithful performance bond in an amount equal to one hundred percent (100%) of the contract price; said bonds shall be secured from a surety company satisfactory to the City.

Note: Projects funded by State and/or Federal Agencies may require labor and material bond to be equal to one hundred percent (100%) of the contract price.

3.06 CONTRACT DOCUMENTATION SAMPLES

The following contract documents are included in these Standard Specifications as samples only and shall not be considered as originals.

a. Public Contract Code Section 10162 Questionnaire (1 page)

b. Public Contract Code Section 10232 Statement (1 page)

c. Contract Proposal (2 pages)

d. Bidder's Bond (2 pages)

PUBLIC CONTRACT CODE SECTION 10162 QUESTIONNAIRE

In accordance with Public Contract Code Section 10162, the Bidder hereby completes, under penalty of perjury, the following questionnaire:

Has the Bidder, or any office of the Bidder, or any employee who has a proprietary interest in the Bidder, ever been disqualified, removed, or otherwise prevented from bidding on, or completing a federal, state, or local government project because of a violation of law or a safety regulation?

Yes_____ No_____

If the answer is yes, explain the circumstances in the following space:

PUBLIC CONTRACT CODE SECTION 10232 STATEMENT

In accordance with Public Contract Code Section 10232, the Contractor, hereby states under penalty of perjury, that no more than one (1) final unappealable finding of contempt of court by a federal court has been issued against the Contractor within the immediately preceding two (2) year period because of the Contractor's failure to comply with an order of a federal court which orders the Contractor to comply with an order of the National Labor Relations Board.

Note: The above Questionnaire and Statement are a part of the Proposal. Signing this Proposal on the signature portion thereof shall also constitute signature, under penalty of perjury, of this Questionnaire and Statement.

Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

To the City of Visalia, State of California

NON COLLUSION AFFIDAVIT
(Title 23 United States Code Section 112 and Public Contract Code Section 7106)

In accordance with Title 23 United States Code Section 112 and Public Contract Code 7106 the Bidder declares that 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; 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 or 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 Date

Note: The above Non-collusion Affidavit is part of the Proposal. Signing this Proposal on the signature portion thereof shall also constitute signature of this Non-collusion Affidavit.

Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

CONTRACT PROPOSAL

Accompanying this proposal is $_____ cash, cashier's check, certified check, or bidder's bond in the amount equal to at least ten percent (10%) of the total bid.

The name of all persons interested in the foregoing proposal as principals are as follows:

IMPORTANT NOTICE: If Bidder or other interested person is a corporation, state legal name of corporation, also names of the president, secretary, treasurer, and manager thereof; if a co-partnership, state true name of firm, also names of all individual copartners composing firm; if Bidder or other interested person is an individual, state first and last name in full.

_____

_____

_____

Licensed in accordance with an act providing for the registration of Contractors, License No._____, Class of License(s) _____,

License Expiration Date _____.

The representations made herein are made under penalty of perjury. Any bid not containing this information, or a bid containing information which is subsequently proven false, shall be considered non-responsive and shall be rejected by the City of Visalia.

Signature of Authorized Person(s)

_____

_____

NOTE: If Bidder is a corporation, the legal name of the corporation shall be set forth above together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation; if Bidder is a co-partnership, the true name of the partner or partners authorized to sign contracts on behalf of the co-partnership; and if Bidder is an individual, his signature shall be placed above. If signature is by an agent, other than an officer of a corporation or a member of a partnership, a Power of Attorney must be on file with the City Clerk prior to opening bids or submitted with the bid; otherwise, the bid will be disregarded as irregular and unauthorized.

BusinessAddress_____

Place of Residence _____Dated: _____

SUBCONTRACTORS

In accordance with the provisions of Section 8.01 of the Standard Specifications, each Bidder shall list below the name and location of place of business of each subcontractor who will perform a portion of the contract work in an amount in excess of one-half of one percent (0.50%) of the total contract price. In each instance, the nature and extent of the work to be sublet shall be described.

The General Contractor to whom the contract is awarded will not be permitted, without the written consent of the Engineer, to substitute any person as subcontractor in place of the subcontractor designated in the original bid, or to permit any subcontract to be assigned or transferred, or to allow it to be performed by anyone other than the original subcontractor. The Engineer may consent to the substitution of another person as subcontractor, if the original subcontractor, after having reasonable opportunity to do so, shall fail or refuse to execute, when said written contract is based upon the conditions of the general contract and complies with the subcontractor's written bid.

The failure of the Contractor to specify a subcontractor for any portion of the contract work in excess of one-half of one percent (0.50%) of the total contract price shall be deemed to indicate that the Contractor intends to perform such portion himself. The subletting or subcontracting of work for which is in excess of one-half of one percent (0.50%) of the total contract price, will be allowed only with the written consent of the Engineer.

Name of Subcontractor, License Number Class of License(s)	Street Address of Office, Mill or Shop	Description of work to be performed (also show Bid Schedule Item No.)

BIDDER'S BOND

TO ACCOMPANY CONTRACT PROPOSAL

Known all men by these presents:

That we, _____ as principal, and _____ as surety, are held and firmly bound unto the City of Visalia in the sum of ten percent (10%) of the total amount of the bid of the principal, to be paid to the said City or its certain attorney, its successors and assigns, for which payment well and truly to be made, we bind ourselves, our heirs, executors, and administrators, successors, or assigns, jointly and severally, firmly by these presented.

In no case shall the liability of the surety hereunder exceed the sum of $_____.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal has submitted the above mentioned bid to the City of Visalia for certain construction specifically described as follows, for which bids are to be opened at _____ on _____ for _____–(Project Number _____).

NOW THEREFORE, if the aforesaid principal is awarded the contract, and within the time and manner required under the specifications, after the prescribed form in accordance with the bid, and files the two (2) bonds with the City of Visalia, one to guarantee faithful performance and the other to guarantee payment of labor and materials, as required by law, then this obligation shall be null and void, otherwise it shall be and remain in full force and virtue.

BIDDER'S BOND

In the event suit is brought upon this bond by the obligee and judgment is recovered, the surety shall pay all costs incurred by the obligee in such suit, including a reasonable attorney's fee to be fixed by the court.

IN WITNESS WHEREOF, we have hereunto set our hands and seals on this _____ day of _____A.DL, 20_____.

_____(Seal)

_____(Seal)

_____(Seal)

_____(Seal)

_____(Seal)

_____(Seal)

Surety

_____

Address

_____

City and Zip Code

NOTE: Signatures of those executing for the surety must be properly acknowledged.

SECTION 4 - GENERAL SCOPE OF WORK AND RESPONSIBILITIES

4.01 WORK TO BE DONE

The work to be performed under this contract consists of furnishing all materials, equipment, supplies, labor and transportation, and performing all work as required by the contract in strict accordance with the specifications, schedules and drawings, all of which are made a part hereof. The work shall be complete, and all work, material and services not expressly called for in the specifications or not shown on the drawings which may be necessary for completion and proper construction to carry out the contract in good faith and leave the site of the work in a neat condition shall be performed, furnished and installed by the Contractor at no increase in cost to the City.

4.02 ALTERATIONS

By mutual consent in writing of the parties signatory to the contract, alterations or deviations, increases or decreases, additions or omissions, in the approved Construction Drawings, these Standard Specifications and the Special Provisions, may be made and the same shall in no way affect or make void the contract.

The City reserves the right to increase or decrease the quantity of any item or portion of the work, or to omit portions of the work as may be deemed necessary or expedient by the Engineer.

4.03 EXTRA WORK

New and unforeseen work will be classed as extra work when such work cannot be covered by any of the various items or combination of items for which there is a bid price.

No extra work shall be done by the Contractor except upon written order from the Engineer.

Extra work, when ordered and accepted, shall be paid for under written work order in accordance with the terms therein provided. Payment for extra work will be made at the unit price or lump sum previously agreed upon by the Contractor and the Engineer, and approved by the City.

4.04 PUBLIC SAFETY AND CONVENIENCE

The Contractor shall so conduct his operations as to cause the least possible obstruction and inconvenience to public traffic. Unless other existing streets are stipulated in the Special Provisions to be used as detours, all traffic shall be permitted to pass through the work. Residents along the road or street shall be provided passage as far as practicable. Pedestrian access to all properties along the line of work shall be provided and maintained in good condition. Not more than one crossing or intersecting street or road shall be closed at any one time without the approval of the Engineer.

The Contractor shall provide such flagmen, and furnish, erect, and maintain such fences, barriers, lights, and signs as are necessary to give adequate warning to the public at all times

that the road, street, or underground utility is under construction and of any dangerous conditions to be encountered as a result thereof, and he shall also erect and maintain such warning and directional signs as may be furnished by the City.

4.05 PUBLIC NOTICE

The Contractor shall inform in writing all residences along the construction length of the start date for the project at least one (1) week prior to start of work. The Contractor shall inform in writing residences of work that will effect ingress and egress from their property at least two (2) days prior but no more than six (6) days prior to the effect taking place.

The Contractor shall be responsible for media notification five (5) days prior to installing an approved traffic control plan when deemed by the City Engineer. Notification shall include a vicinity map with alternate routes available and be approved by the City Engineer. Traffic control shall coordinate with the order of work and schedule of operations in accordance with Section 5.10 in these Standard Specifications.

Any written notification must be approved by the Project Engineer prior to distribution. All notifications shall include contact information for the City and the Contractor.

Full compensation for conforming to this Section shall be considered to be included in the contract price paid for the various items of work and therefore, no additional compensation shall be allowed.

4.06 DUST CONTROL

The Contractor shall maintain dust control about the site of the work, including any haul roads to or from the site, by whatever means are necessary, such as watering, sweeping or oiling, so as to cause the least possible dust nuisance to the public. Any dust control measure ordered by the Engineer shall be promptly and immediately carried out.

Water for dust control purposes will be furnished as specified in the Special Provisions of these Standard Specifications. The Contractor shall furnish his own equipment for transporting and applying water. Such equipment shall meet the approval of the Engineer. The Contractor shall provide, at all times, an approved backflow prevention device between the public water supply and his equipment for applying or transporting water or when the Engineer determines that a backflow condition could be caused by the method or equipment used to draw water from the public supply.

If the Contractor fails to provide dust control measures so ordered within a reasonable time period as determined by the Engineer, the Contractor or Developer shall pay to the City a penalty of fifteen dollars ($15.00) for each one-half of one (½) hour, or portion thereof, that elapses from the time the penalty is ordered into effect by the Engineer, until dust control measures ordered by the Engineer are completely carried out and the dust nuisance eliminated or prevented.

Such penalty shall be deducted from any monies owed the Contractor or levied as a fine against the Developer. In addition to the penalty as specified above, if conditions warrant, the Engineer may order City forces to eliminate or prevent the dust nuisance. The full cost thereof,

in addition to the penalty as herein provided, shall be deducted from any monies owed the Contractor or shall be levied as a fine against the Developer.

Full compensation for dust control shall be included in the amount bid for the various items of work and no separate payment will be made therefore, unless otherwise specified in the Special Provisions.

4.07 TRAFFIC CONTROL

All traffic and detour patterns shall be as indicated in the Special Provisions or as specified in the permit issued for the work by the City. Any deviations proposed by the Contractor shall have the approval of the Engineer.

The Contractor shall comply with all of the requirements of the State of California Department of Transportation (Caltrans) "Manual of Traffic Controls for Construction and Maintenance Work Zones".

Compliance with the requirements of said manual shall be considered as a minimum requirement and it shall be the responsibility of the Contractor to provide additional safety devices when necessary to maintain a safe condition.

It shall be totally the responsibility of the Contractor to provide and maintain adequate traffic safety devices and warning signs. If the Engineer or the Inspector of the City, notes some deficiency in said devices, the situation shall be corrected immediately by the Contractor.

All traffic signs used within the City of Visalia shall be minimum eight-hundredths of one inch (.080") thickness sign-grade aluminum with 3M™ Diamond Grade™ 3 (Diamond Grade Cubed) Series 4000 Reflective Sheeting or approved equal with 3M™ Series 1160 Anti-Graffiti coating or approved equal. Signs and installation shall conform to Caltrans' latest MUTCD Standards or as directed by the City Engineer.

Full compensation for all costs involved in maintaining traffic control in the vicinity of the work in accordance with the requirements specified shall be included in the lump sum price bid for traffic control. If no bid item is provided for traffic control, the cost therefore shall be included in the various bid items of work.

4.08 COOPERATION

The Contractor shall cooperate in all respects with all public and private agencies, including, but not limited to, the Kaweah Irrigation District, Southern California Gas Company, Comcast, California Water Service, Southern California Edison, AT&T Telephone Company, and the Fire and Police Departments. Should construction be underway by other forces or by other Contractors within or adjacent to the project area, or should work of any other nature be underway by other forces within or adjacent to said project area, the Contractor shall cooperate with all such other Contractors or forces to the end that any delay or hindrance to their work will be avoided.

4.09 PERMITS AND EASEMENTS

The Contractor shall obtain any necessary permits from the County of Tulare, City of Visalia, California Department of Transportation, California Division of Industrial Safety as required by Section 6424 of the California Labor Code, any Railroad or Utility Company, Special District, or Agency affected by the work.

Satisfactory evidence of obtaining the required permits shall be submitted to the Engineer prior to, and as a condition of, issuance of the "Notice to Proceed". The Contractor shall abide by the conditions of said permits and perform all work governed by said permits in conformance therewith and as directed by the Engineer. The Contractor shall procure at no cost to the City all temporary construction easements not shown in the approved Construction Drawings, which he may deem necessary to carry out the work to be done under the contract. Should the Contractor desire to make preliminary soil investigations in public street right of way, he shall secure the required permits from the appropriate department of the City and abide by the provisions of said permits.

4.10 EXISTING IMPROVEMENTS

The Contractor shall preserve all curbs, gutters, sidewalks, and other existing improvements in the vicinity of the work. Any curbs, gutters, sidewalks and other existing improvements damaged by the Contractor's operation shall be replaced at the Contractor's expense.

The Contractor shall be responsible for the protection, restoration or replacement in kind of any improvements such as, but not limited to, lawn, trees, shrubs, hedges, fences, mail boxes, signs, poles, sprinkler systems, walls, sidewalks, driveways, curb and gutter and pavement existing at the start of the work. Replacement and restoration of said improvements shall meet the approval of the Engineer and shall be made immediately upon notification by the Engineer. At locations where work occurs behind curb lines and/or within landscaped areas, all external structure patching, final backfilling, final sprinkler system repairing and lawn reseeding and mulching behind the curb lines shall be completed within fifteen (15) calendar days of beginning of the work.

Irrigation and sprinkler system lines behind the curb disturbed by the construction shall be repaired as follows:

a. Sprinkler or irrigation lines disturbed by structure construction shall be temporarily capped when first disturbed.

b. Sprinkler or irrigation lines and facilities disturbed shall be replaced to original condition using similar material as removed. (Galvanized pipe to be replaced with galvanized pipe, brand name heads replaced with same brand name and model.) Sprinkler lines shall be realigned around structures in order to duplicate original irrigation coverage.

c. Sprinkler systems disturbed and repaired shall be water-tested by the Contractor in the presence of the Engineer before acceptance of the repair.

Existing land subdivision monuments and stakes shall be fully protected from damage or

displacement and they shall not be disturbed unless directed by the Engineer.

All costs involved in the protection, restoration and replacement of existing improvements as specified herein shall be considered as being included in the bid prices of the various items of work, and no separate payment shall be made therefore, unless otherwise specified in the Special Provisions.

4.11 MAINTAINING DRAINAGE

Reference is made to Section 12.05.d of these Standard Specifications. The Contractor shall also provide and maintain drainage to the existing street sections with no separate compensation therefore.

During and following storm conditions, the Contractor shall cooperate with the Engineer in providing for temporary use, for drainage purposes, of completed or partially completed drainage facilities. Temporary provisions for drainage of any area during construction where existing facilities have been damaged or altered by the Contractor during his operations shall be made by the Contractor and as directed by the Engineer.

No separate payment shall be made for maintaining of drainage, and full compensation therefore, shall be included in the prices bid for the various items of work.

The Contractor shall be responsible for all damages to public or private property incurred due to the following: failure to provide adequate drainage within the construction area; blockage of existing drainage facilities upstream from the area of work in excess of the capacity of the existing upstream drainage facilities.

4.12 ELECTRIC AND WATER SERVICES

The Contractor shall provide and pay for electric service for all purposes of power and lighting required for the construction of the work of the contract and shall maintain such service until the completion of the contract.

The Contractor shall contact the California Water Service concerning the use of water for the work done under the contract. All water so used shall be paid for by the Contractor as specified in the Special Provisions.

4.13 RIGHT-OF-WAY

The right of way for the work to be constructed will be provided for, but the Contractor shall make his own arrangements and pay all expenses for additional area required by him outside of the limits of the right of way as shown on the approved Construction Drawings, unless otherwise provided in the Special Provisions. Said additional right of way shall be brought, to the satisfaction of the Engineer, to a condition at least equal to that existing prior to its use by the Contractor.

4.14 CONTRACTOR'S EQUIPMENT

The Contractor shall provide adequate and suitable equipment and means of construction to meet all the requirements of the work. When ordered to do so by the Engineer, the Contractor shall remove unsuitable equipment from the work and discontinue the operation of unsatisfactory equipment. The use of any means of construction which is obsolete as to type, in bad condition, or worn out will not be permitted on the work. The Contractor shall, at his expense, provide off-street storage for equipment not used for that day's work.

4.15 DISPOSAL OF MATERIAL

The Contractor shall make his own arrangements for disposing of materials and he shall pay all costs involved.

All material shall be disposed in accordance with Section 7-1.13 of the State of California Standard Specifications.

When any material is to be disposed of on private property, the Contractor shall first obtain a written permit from the property Owner of whose property the disposal is to be made, and he shall file with the Engineer said permit or a certified copy thereof if such proof is requested by the Engineer.

Unless otherwise provided in the Special Provisions, full compensation for all costs involved in disposing of materials as specified, including all costs of hauling, shall be considered as included in the price paid for the contract item of work involving such materials, and therefore no additional compensation will be allowed.

4.16 PRECONSTRUCTION AND MOBILIZATION/DEMOBILIZATION

Prior to the start of construction, a meeting will be called by the City with the Contractor, Engineer, and all others concerned, including utility companies, to coordinate and schedule the proposed work in order to avoid all possible delays due to conflicts of operation. At this meeting, the Contractor shall submit for City review/approval a construction schedule in bar chart form indicating all critical path operations.

Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all offices, buildings, staging yards, and other facilities necessary for the work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site, including, but not limited to bond premiums and insurance premiums.

Demobilization shall consist of all closing work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals off the Project Site, and for all other work and operations which must be performed to complete the project, including clean-up.

The contract lump sum price paid for Mobilization and Demobilization shall include full

compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in mobilization and demobilization.

SECTION 5 - CONTROL OF WORK

5.01 AUTHORITY OF THE ENGINEER

The Engineer shall decide all questions which may arise as to the quality of acceptability of materials furnished and work performed and as to the manner of performance and rate of progress of the work, all questions which may arise as to the interpretation of the approved Construction Drawings, these Standard Specifications and the Special Provisions, all questions as to the acceptable fulfillment of the contract on the part of the Contractor, and all questions as to compensation. His decision shall be final and he shall have authority to enforce and make effective such decisions and orders which the Contractor fails to carry out promptly.

5.02 PLANS

Working drawings or plans for any structure not included in the approved Construction Drawings furnished by the Engineer shall be approved by the Engineer before any work involving these plans shall be performed, unless approval is waived in writing by the Engineer.

It is mutually agreed, however, that the approval by the Engineer of the Contractor's working plan does not relieve the Contractor of any responsibility for accuracy of dimensions and details, and that the Contractor shall be responsible for agreement and conformity of his working plans with the approved Construction Drawings, these Standard Specifications and the Special Provisions.

5.03 CONFORMITY WITH PLANS AND ALLOWABLE DEVIATION

Finished surfaces in all cases shall conform with the lines, grades, cross-sections, and dimensions shown in the approved Construction Drawings. Deviations from the approved Construction Drawings, as may be required by the exigencies of construction, will be determined in all cases by the Engineer and authorized in writing by him.

5.04 COORDINATION OF PLANS, SPECIFICATIONS AND SPECIAL PROVISIONS

The approved Construction Drawings, these Standard Specifications, the Special Provisions, and all supplementary documents are essential parts of the contract, and a requirement occurring in one, is as binding as though occurring in all. They are intended to be cooperative, to describe, and to provide for complete work. The approved Construction Drawings, shall govern over specifications; Special Provisions shall govern over both specifications and the approved Construction Drawings,. These Standard Specifications shall govern over the State of California Standard Specifications.

5.05 INTERPRETATION OF PLANS AND SPECIFICATIONS

Should it appear that the work to be done, or any matter relative thereto, is not sufficiently detailed or explained in the approved Construction Drawings, these Standard Specifications and the Special Provisions, the Contractor shall apply to the Engineer for such further

explanations as may be necessary, and shall conform to such explanation or interpretation as part of the contract, so far as may be consistent with the intent of the original specifications. In the event of doubt or question relative to the true meaning of these Standard Specifications, reference shall be made to the City Engineer, whose decision thereon shall be final.

Lists, rules and regulations referred to are recognized printed standards and shall be considered as one and part of these Standard Specifications within the limits specified. Catalog numbers shall be likewise so considered.

In the event of any discrepancy between any drawings and the figures written therein, the figures shall be taken as correct.

5.06 OMISSIONS IN SPECIFICATIONS AND DRAWINGS

Any material or work mentioned in these Standard Specifications and not shown on the drawings or shown on the drawings and not mentioned in these Standard Specifications shall be of the same effect as if shown or mentioned in both.

Omissions from the drawings or these Standard Specifications of the materials or details of work which are manifestly or obviously necessary to carry out the intent of the drawings and specifications, or which are customarily furnished or performed, shall not relieve the Contractor of his responsibility for furnishing such omitted materials or performing such omitted work; but shall be furnished or performed as if fully shown or described in the drawings or specifications.

5.07 SURVEYING

a. Permanent Survey Markers: The Contractor shall not disturb permanent survey monuments or benchmarks without the consent of the Engineer and shall bear the expense of replacing any that may be disturbed without permission. Any such monument disturbed without permission shall be replaced at the expense of the Contractor.

   When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, the Contractor shall adjust the monument cover to the new grade, unless otherwise specified.

b. Lot Stakes: The Contractor shall preserve property line and corner survey markers except where their destruction is unavoidable, and the Contractor is proceeding in accordance with accepted practice. Markers that otherwise are lost or disturbed by his operations, shall be replaced at the Contractor's expense by a Registered Civil Engineer or Licensed Land Surveyor.

c. Survey Service: Surveying for construction will be done by the Engineer except for private contracts. The extent that survey stakes will be provided shall be as set forth in the Special Provisions. The Contractor shall be responsible for preserving construction survey stakes and marks for the duration of their usefulness. If any construction survey stakes are lost or disturbed and need to be replaced, such

replacement shall be by the Engineer at the expense of the Contractor.

The Contractor shall notify the Engineer in writing at least two (2) working days before he will require survey services in connection with laying out of any portion of the work. The Contractor shall, upon request from the Engineer, clear the construction area prior to the setting of any stakes at no additional cost to the City.

d. Private Engineer: Surveying by Private Engineers for work under control of the City shall conform to the quality and practice required by the Engineer. The Engineer shall be notified before the stakes are set. Private Engineers are required to furnish cut sheets to the Engineer immediately upon setting of the grades. On work where staking is done by other than the Engineer, the Engineer will check any staking that is in question. The Engineer shall be the authority to reset grades if a discrepancy exists or order the work corrected by the Engineer responsible for the staking work. No other work shall continue until the stakes ordered to be corrected have been reset to their proper alignment or grade or both.

e. Line and Grade: All work upon completion shall conform to the lines, elevations, and grades shown in the approved Construction Drawings,.

Three (3) consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

Grades for underground conduits will be set at the surface of the ground. The Contractor shall transfer them to the bottom of the trench.

5.08 INSPECTION

The Engineer and the Inspector shall at all times have access to the work during construction, and shall be furnished with every reasonable facility for ascertaining full knowledge respecting the progress, workmanship, and character of materials used and employed in the work.

Whenever the Contractor varies the period during which work is carried out each day, he shall give due notice to the Engineer, or Inspector, so that proper inspection may be provided. Any work done in the absence of the Engineer or Inspector will be subject to rejection.

The inspection of the work shall not relieve the Contractor or 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 and unsuitable materials have been previously overlooked by the Engineer and Inspector and accepted or estimated for payment.

Projects financed in whole or in part with State and/or Federal funds shall be subject to inspection at all times by the designated Engineer of the Agency involved or their agent.

5.09 FINAL INSPECTION

Whenever the work provided and contemplated by the contract shall have been satisfactorily completed and the final cleaning up performed, the Engineer and the Public Works Inspector will make the final inspection.

5.10 ORDER OF WORK; SCHEDULE OF OPERATIONS

The Contractor shall follow the sequence of operations for a successful completion as rapidly as possible. The Contractor shall submit a proposed schedule of operations with the executed contracts or with requested encroachment permits and construction traffic control submittals for work.

The Engineer shall also have the power to direct the order and sequence of work, which in general shall be to coordinate the construction of several parts of the contract to a successful completion as rapidly as possible.

If at any time appliances used or to be used appear to the Engineer as insufficient or improper for securing the quality of work required, or the required progress, he may order the Contractor to increase efficiency or to improve their appliance results and the Contractor shall conform to such order but the failure of the Engineer to demand any increase of such efficiency or any improvement shall not release the Contractor from his obligation to secure the quality of work or the rate of progress specified.

Full compensation for conforming with such requirements will be considered as included in the prices paid for the various contract items of work, and therefore no additional compensation will be allowed.

5.11 EMERGENCY AVAILABILITY

The Contractor shall furnish to the City, prior to the issuance of the "Notice to Proceed," a list of the persons, together with their addresses and home and cellular telephone numbers, who are authorized to act on the behalf of the Contractor in an emergency arising out of conditions at the work site after normal working hours.

5.12 SANITARY REGULATIONS

Necessary housing accommodations shall be provided for the workmen for changing clothes and for protection during inclement weather. Toilet accommodations shall also be maintained for the use of employees on the work site. The accommodations shall be in approved locations property screened from public observation and shall be maintained in a strictly sanitary manner. The Contractor shall obey and enforce all other sanitary regulations and orders, and shall take precautions against infectious diseases, and the spread of same, and shall maintain at all times satisfactory sanitary conditions around all shanties, tool and supply houses, and on all other parts of the work.

5.13 EXISTING STRUCTURES AND UTILITY FACILITIES SHOWN ON THE PLANS

a. Location: Where underground and surface structures of utilities are shown on the approved Construction Drawings, the locations, depth and dimensions of such structures or utilities are believed to be reasonably correct, but are not guaranteed. Such structures or utilities are shown for the information of the Contractor, but information so given is not to be construed as a representation that such structures or utilities will, in all cases, be found or encountered just where shown, or that they represent all the structures or utilities which may be encountered.

   The Contractor shall be responsible for precisely locating and preserving said underground or surface structures and utility lines and shall, prior to placing or constructing the proposed facilities, expose and/or verify the locations of said utilities and structures. If the Contractor discovers utilities or structures not identified on the approved Construction Drawings, he shall immediately notify the Engineer and the utility or structure Owner in writing.

   At least three (3) working days before entering on the work, the Contractor shall request all Utility Owners having a possible interest in the work area to mark or otherwise indicate the location of their substructure. It shall be the Contractor's responsibility to determine the true location and depth of all utilities and service connections. He shall also familiarize himself with the type, material age and condition of any utility which may be affected by the work.

   The cost of verifying the locations of said utility facilities indicated on the approved Construction Drawings, including exposing them prior to construction, shall be considered as being included in the various bid items of work and therefore no separate payment will be made.

b. Relocation: Whenever it is shown on the approved Construction Drawings or the Special Provisions that, sewer or other facilities or structures are to be relocated, such work shall be done by the Contractor in cooperation with other such utilities. In such a case, the Contractor shall cooperate fully in completing the relocation. Unless otherwise specified, the cost for relocation of the utilities shall be included in the various bid items of work, and therefore no additional payment shall be made.

   Should the Contractor desire to have any relocation made of any utility facility, or other improvement, for his convenience in order to facilitate his construction operations, which relocation is in addition to or different from the relocations indicated on the approved Construction Drawings or in the Special Provisions, he shall make whatever arrangements are necessary with the Owners of such utility for such relocation and bear all expenses in connection therewith.

c. Care of Existing Structures and Utilities: The Contractor shall be liable for all damage done to any structure or utility arising through his negligence and carelessness. He shall take care of and maintain all sewers, drains and culverts encountered in the performance of said work, together with the house services. The Contractor shall take care of all pipes for water, sewer, steam or gas and all wire conduits as well as the underground structures crossing said work, whether shown

on the approved Construction Drawings or not.

The Contractor shall repair in accordance with the requirements of the Owner of the utility or structure, all damage done to any structure or utility through his acts or neglect and shall keep them in repair during the life of his contract. He shall, in all cases, leave them in as good condition as they were previous to the commencement of the work.

Care shall be taken not to move, without the consent of the Engineer, any sewers, drains, culverts, water, gas or other pipes, poles or other structures; and in crossing or running parallel with such structures, they shall be securely hung, braced and supported in place until the work is completed.

The full cost of protection, repair, or replacement of utilities shall be included in the various bid items or work and therefore no additional compensation will be paid.

d. Utility Facilities Not Shown on the Plans; Mains and Trunklines: The Contractor will be compensated for the cost of locating, repairing damage not due to his failure to exercise reasonable care, and for removing or relocating main or trunkline utility facilities not indicated in the approved Construction Drawings, theses Standard Specifications and the Special Provisions with reasonable accuracy. Said compensation will be paid for as "extra work," in accordance with Sections 4.03 and 9.04 of these Standard Specifications. Compensation shall include the cost of equipment on the project necessarily idled during such work.

   In lieu of relocating an underground utility not shown in the approved Construction Drawings, as indicated above, the Engineer may direct that the proposed underground facility be shifted in location or elevation. In such a case, the additional work resulting therefrom shall be classed as extra work and the increase in compensation will be paid for as specified above, except for shifts in depth or alignment less than one (1) foot, in which case no additional compensation will be paid.

e. Limitation of Liability: City: Except for the assumption of liability as may be required by statute and such liabilities assumed in accordance with Section 5.13.d of these Standard Specifications, the City assumes no responsibility or liability in respect to the sufficiency or accuracy of the information or investigation of the location of structures or utility facilities made by it, or in respect to the actual or apparent location of all known structures or utility facilities as indicated in the approved Construction Drawings, or in respect to unlooked for developments which may occur as to the location of such structures or utility facilities which may be encountered at places different from that indicated.

5.14 REMOVAL OF DEFECTIVE AND UNAUTHORIZED WORK

All work which is defective in its construction or deficient in any of the requirements of these Standard Specifications shall be remedied, or removed and replaced by the Contractor in an acceptable manner, and no compensation will be allowed for correction.

Upon failure on the part of the Contractor to comply forthwith with any order of the Engineer made under the provisions of this article, the Engineer shall have authority to cause defective work to be remedied, or removed and replaced, and unauthorized work to be removed, and to deduct the costs thereof from any monies due or to become due the Contractor.

5.15 "AS-BUILT" PLANS

The Contractor shall prepare and submit to the City a complete set of "As-Built" Plans documenting all changes and deviations from the approved Construction Drawings. The "As-Built" Plans must be submitted to the City and approved by same prior to the request for final payment.

Payment for the "As-Built" Plans and all related costs shall be considered as included in the total Contract price paid for the various items of work and no additional compensation provided.

SECTION 6 - CONTROL OF MATERIALS

6.01 SUBMISSION OF DATA WHERE "OR CITY APPROVED EQUAL" IS SPECIFIED

Wherever an article or any class of materials is specified by the trade name or by the name of any particular patentee, manufacturer, or dealer, or by reference to the catalog of any such manufacturer or dealer, it shall be taken as intending to mean and specify the article of material described or any other equal thereto in quality, finish, and durability and equally as serviceable for the purpose for which it is, or they are, intended. The intent of the approved Construction Drawings and these Standard Specifications is to specify high grade standard equipment, and it is not the intent of the approved Construction Drawings and Standard Specifications to exclude or omit the products of any responsible manufacturer if such products are equal in every respect to those mentioned herein.

Whenever the material or article to be furnished is described in these Standard Specifications by trade name, brand name, or other reference is made to specific manufacturers or supplies, "or City approved equal," the person to whom the contract is awarded shall have thirty (30) days after the award of the contract to submit to the Engineer data substantiating a request for the substitution of a "City approved equal" item. The Engineer together with the Public Works Department of the City will make a decision as to whether the product proposed to be furnished is of equal quality and performance and equally suited for the City's purposes.

6.02 SAMPLES AND TESTS

At the option of the Engineer, the source of supply of each of the materials shall be approved by the Engineer before delivery is started and before such material is used in the work. Representative preliminary samples of the character and quality prescribed shall be submitted by the Contractor or producer of all materials to be used in the work, for testing or examination as desired by the Engineer.

The cost of testing shall be borne by the City for work performed under contract by the City. The cost for repeat testing shall be borne by the Contractor. All other tests required for work in City streets and not under contract with the City shall be borne by the Contractor or Developer.

All tests shall be made under the direction of the Engineer by a certified testing laboratory, whether the cost therefore is borne by the City, the Contractor or Developer, and all results shall be furnished to the Engineer when said results are available.

The Contractor shall provide adequate notice to the Engineer when he desires the required testing. A City Engineering Representative shall coordinate with the testing agency to be present on site for all testing.

Any test of materials furnished by the Contractor shall be made in accordance with the commonly recognized standards of national organizations, and such special methods and tests as are prescribed in these Standard Specifications.

The Contractor shall furnish such samples of materials as are requested by the Engineer without charge. No material shall be used until it has been approved by the Engineer. Samples will be secured and tested whenever necessary to determine the quality of materials by such

laboratories as authorized by the Engineer.

6.03 CERTIFICATE OF COMPLIANCE

A "Certificate of Compliance" stating that the materials to be used in the work, comply in all respects with the requirements of the approved Construction Drawings, these Standard Specifications and the Special Provisions shall be supplied to the Engineer upon request. The Certificate shall be signed by the manufacturer of the material or the manufacturer of assembled material delivered to the work, and the lot so certified must be clearly identified in the Certificate.

All materials used on the basis of a "Certificate of Compliance" may be tested and sampled at any time. The fact that the material is used on the basis of a "Certificate of Compliance" shall not relieve the Contractor of responsibility for incorporating material in the work which conforms to the requirements of the approved Construction Drawings, these Standard Specifications and the Special Provisions, and any such material not conforming to such requirements will be subject to rejection whether in place or not.

The City reserves the right to refuse to permit the use of material on the basis of a "Certificate of Compliance".

The form of the "Certificate of Compliance" and its disposition shall be as directed by the Engineer.

6.04 DEFECTIVE MATERIAL

All materials not conforming to the requirements of these Standard Specifications shall be considered as 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 Engineer. No rejected material, the defects of which have subsequently been corrected, shall be used until approved by the Engineer.

Upon failure on the part of the Contractor to comply with any order of the Engineer made under the provisions of this article, the Engineer shall have authority to remove and replace defective material and to deduct the cost of removal and replacement from any monies due or to become due the Contractor.

6.05 GUARANTEE OF MATERIALS AND WORKMANSHIP

The Contractor shall guarantee all materials, equipment and workmanship of the installation. Should any material or appliance or any work develop any defect or weakness due, in the opinion of the Engineer, to the use of imperfect materials, equipment or workmanship, or failure to follow the approved Construction Drawings, these Standard Specifications or the Special Provisions, the Contractor shall be notified at once, and he shall immediately, at his own expense, make the necessary repairs or replacements to make the defective item or items suitable and satisfactory. Should the exigencies be such as to necessitate the repairs before the Contractor could be notified, the City shall have the right to make the necessary repairs or

replacements at the expense of the Contractor, preserving as far as possible all available evidence of the cause of the failure.

This guarantee is not intended to include the damage by the actions of individuals other than the Contractor's forces, or by damages due to the activities of other Contractors working in the area, either during the time this work is under construction or after its acceptance. Attention is directed to Sections 7.11 and 7.15 of these Standard Specifications.

6.06 SALVAGE OF MATERIALS

Where indicated on the approved Construction Drawings, materials to be salvaged shall remain the property of the City and shall be delivered and deposited by the Contractor at the location specified by the Engineer. No separate payment will be made for such salvaging and delivering of material, and the cost thereof shall be included in the various bid items of work.

6.07 PRE-JOB TESTS

In accordance with Section 2.04 of these Standard Specifications, the Contractor shall conduct at his expense, prior to bidding any project, any tests he may deem necessary to satisfy himself as to any existing oil or underground conditions that may exist at the work site. Attention is directed to Section 17.05 of these Standard Specifications. Submission of a bid shall be deemed conclusive evidence that the Contractor has conducted such tests.

6.08 FOREIGN MATERIALS

All foreign material shall be in accordance with the State of California Standard Specifications as noted in Section 6-1.08.

SECTION 7 - LEGAL RELATIONS AND RESPONSIBILITIES

7.01 LAWS TO BE OBSERVED

The Contractor shall keep himself fully informed of all existing State and National laws and all municipal ordinances and regulations of the City which in any manner affect those engaged or which in any way affect the conduct of the work, and of all such orders and decrees of bodies of tribunals having any jurisdiction or authority over the same.

7.02 NOISE ORDINANCE

The Contractor's work shall conform to all municipal ordinances pertinent to noise, including but not limited to, the City of Visalia's Municipal Code Chapter 8.

7.03 UNDOCUMENTED LABOR

The Contractor shall forfeit as a penalty to the City, twenty-five dollars ($25.00) for each undocumented knowingly employed in the execution of the contract, by him or by any subcontractor under him, on any of the work herein mentioned, for each calendar day, or portion thereof, during which such undocumented labor is permitted or required to labor in violation of the provisions of the California Labor Code and in particular, Sections 1850 to 1854 thereof, inclusive.

7.04 HOURS OF LABOR

Eight (8) hours constitutes a legal day's work. The Contractor shall forfeit, as a penalty to the City, twenty-five dollars ($25.00) for each worker employed in the execution of the contract by the Contractor or any subcontractor under him for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any one (1) calendar day and forty (40) hours in any one (1) calendar week in violation of the provisions of the California Labor Code, and in particular, Sections 1810 and 1815 thereof, inclusive, except that work performed by employees of Contractors in excess of eight (8) hours per day, and forty (40) hours during any one (1) week, shall be permitted upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half (1½) times the basic rate of pay, as provided in said Section 1815 of the California Labor Code.

7.05 TRAVEL AND SUBSISTENCE

The Contractor, and each subcontractor under him, shall pay travel and subsistence payments to each workman needed to execute the work, as such travel and subsistence payment are defined in the applicable collective bargaining agreements filed in accordance with Section 1773.8 of the California Labor Code.

7.06 PREVAILING WAGE, PAYROLL

Pursuant to Resolution 83-02, adopted by the City of Visalia City Council on January 3, 1983 a prevailing wage rate is not established or required for all projects. When a project requires

prevailing wage rate, the following shall dictate.

a. The Contractor shall forfeit as penalty to the City twenty-five dollars ($25.00) for each calendar day or portion thereof for each worker paid less than the stipulated prevailing rates for any work done under the contract by him or by any subcontractor under him in violation of the provisions of the California Labor Code, and the Contractor shall comply in particular with the provisions of Section 1775 thereof.

b. The City will not recognize any claim for additional compensation because of the payment by the Contractor of any wage rate in excess of the prevailing wage rate. The possibility of wage increases in one of the elements to be considered by the Contractor in determining his bid will not, under any circumstances, be considered as the basis of a claim against the City.

c. In accordance with the provisions of Section 1770 of the California Labor Code, copies of the prevailing rate of per diem wages as determined by the Director of the Department of Industrial Relations are on file in the office of the City Engineer and will be made available to any interested party on request. The successful Bidder shall post a copy of such determination at each job site.

d. If specified in the Special Provisions, or if requested by the Engineer, certified copies of payrolls shall be submitted within ten (10) calendar days following the close of the normal pay period or periods. If certified copies of the Contractor's payrolls are requested by the Engineer or specified to be furnished in the Special Provisions, payment for furnishing said certified copies of payrolls shall be considered as included in the various contract items of work and no additional payment will be made therefore.

7.07 LABOR DISCRIMINATION

No discrimination shall be made in the employment of persons within Public Works because of race, color, or religion of such persons and every Contractor for Public Works violating this section is subject to the penalties imposed for a violation of Chapter 1 of Part VII, Division 2 of the California Labor Code, in accordance with the provisions of Section 1735 of said Code.

7.08 APPRENTICES

In accordance with the provisions of Section 1777.5 of the California Labor Code, and in accordance with regulations of the California Apprenticeship Council, properly indentured apprentices shall be employed in the prosecution of the work. Information relative to number of apprentices, identification, wages, hours of employment and standards of working conditions shall be obtained from the Director of the Department of Industrial Relations of the State of California.

The Contractor herein is hereby designated as the "Prime Contractor" and as such is responsible for the compliance with Section 1777.5 of the California Labor Code relating to apprentices, craftsmen or tradesmen, and shall hold the City harmless in all respects from any

failure to do so.

7.09 REGISTRATION OF CONTRACTORS

No contract will be awarded to a Contractor who has not been licensed in accordance with the provisions in Chapter 791, Statutes of 1929, as amended.

7.10 PATENTS

The Contractor shall assume all responsibilities and costs arising from the use of patented materials, equipment, devices, or processes used on or incorporated in the work, and shall indemnify and hold harmless the Engineer, City, and their duly authorized representatives from all suits at law or actions or every nature for or on the account of the use of any patented materials, equipment, devices, or processes used on or incorporated in the work.

7.11 PERMITS AND LICENSES

The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notice necessary and incidental to the due and lawful prosecution of the work.

7.12 RESPONSIBILITY FOR DAMAGE

The City, the City Council, the County of Tulare, the State of California, the United States of America or the Engineer shall not be answerable or accountable in any manner for any loss or damage that may happen to the work or any part thereof, or any material or equipment used in performing the work, or for injury or damage to any person or persons, either worker or public, or for damage to adjoining property from any cause whatsoever during the progress of the work or at any time before final acceptance.

The Contractor shall indemnify and hold harmless the City, the City Council, the County of Tulare, the State of California, the United States of America and the Engineer from any suits, claims or actions brought by any person or persons or on account of any injuries or damages sustained or arising in the construction of the work or in consequence thereof. The City Council may retain so much of the money due the Contractor as shall be considered necessary, until disposition has been made of such suit or claims for damages as aforesaid.

The provisions of this section requiring indemnification of the County of Tulare and the United States of America shall apply only if Federal funding administered through the County of Tulare is funding any portion of the work to which these Standard Specifications apply.

7.13 PRESERVATION OF PROPERTY

Due care shall be exercised to avoid injury to existing highway improvements or facilities, utility facilities, adjacent property, and roadside trees and shrubbery that are not to be removed and pole lines, fences, signs, survey markers and monuments, building and structures, conduits, pipe lines under or above ground, sewer and water lines, all highway facilities, and

any other improvements of facilities within or adjacent to the highway shall be protected from injury or damage, and if ordered by the Engineer, the Contractor shall provide and install suitable safeguards, approved by the Engineer, to protect such objects from injury or damage. If such objects are injured or damaged by reason of the Contractor's operations, they shall be replaced or restored to a condition as good as when the Contractor entered upon the work, or as good as required by these Standard Specifications being performed under the contract. The Engineer may make or cause to be made such temporary repairs as are necessary to restore to service any damaged highway facility and utility facilities. The cost of such repairs shall be borne by the Contractor and may be deducted from any monies due or to become due to the Contractor under the contract.

7.14 CONTRACTOR'S LIABILITY

The Contractor shall provide liability insurance in accordance with the provisions of the agreement pertaining to the specific project.

7.15 WORKER'S COMPENSATION INSURANCE

The Contractor shall secure the payment of Worker's Compensation Insurance in compliance with the provision of the California Labor Code and during the performance of the work will continue so to comply with said provisions of said code. Contractor shall supply the City with certificates of insurance evidencing that Worker's Compensation Insurance is in effect and providing that the City will receive ten (10) days notice of cancellation. If the Contractor self-insures Worker's Compensation, Certificate of Consent of Self-Insure shall be provided to the City.

7.16 CONTRACTOR'S RESPONSIBILITY FOR WORK

Except as provided in these Standard Specifications, until the formal acceptance of the work by the City Council, the Contractor shall have the charge and the care thereof 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 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 of the above causes before final acceptance and shall bear the expense thereof, except such injuries or damages occasioned by acts of the Federal Government or the public enemy.

The Contractor shall check with the utility companies for the exact location of all existing underground installations. The lines as shown on the approved Construction Drawings may not conform to the exact location in the field and the Contractor shall protect all existing lines and shall replace or repair any damage at his expense and no additional compensation will be charge against the City.

Attention is directed to Sections 6.05 and 7.11 of these Standard Specifications.

7.17 NO PERSONAL LIABILITY

Neither the City Council, the Engineer, nor any other officer or authorized assistant or agent shall be personally responsible for any liability arising under the contract.

7.18 RESPONSIBILITY OF CITY

The City shall not be held responsible for the care or protection of any material or parts of the work prior to final acceptance except as expressly provided in these Standard Specifications.

7.19 SAFETY PROVISIONS

The Contractor shall conform to the rules and regulations pertaining to safety established by the California Division of Industrial Safety. All regulations included in the California Occupational Safety and Health Act of 1973 shall be complied with.

a. Job Safety and Special Worker Protection from Toxic or Explosive Gases: The Contractor shall comply with the provisions of the Construction Safety Orders, Tunnel Safety Orders and General Safety Orders issued by the State Division of Industrial Safety, as well as all other applicable laws, ordinances and regulations.

   In conformance with said Safety Orders, the Contractor shall protect workers from toxic or explosive gases by providing whatever testing equipment and other special equipment that may be needed to detect the presence of and to remove such toxic or explosive gases found to exist in any underground facilities involved in the work, whether these facilities are newly constructed or existing.

   The above requirements of the State Division of Industrial Safety are minimum requirements. In addition, the Contractor shall provide, for the life of the contract, similar protection for any person, including the Engineer or any of his authorized representatives, subcontractors, or any other person authorized or required to enter such underground facilities for inspection, repairs, or any other reason.

   Full compensation for all costs involved in providing such job safety and special worker protection, except those pertaining to the hazards of caving ground in excavation, shall be included in the amounts bid for the various items of work, and no separate payment will be made therefore.

b. Worker Protection at Excavations: The Contractor shall comply with the provisions of the Construction Safety Orders, Tunnel Safety Orders, and General Safety Orders issued by the State Division of Industrial Safety, as well as all other applicable laws, ordinances and regulations, as they pertain to the protection of workers from the hazard of caving ground.

   In addition, in compliance with the provisions of Section 6705 of the California Labor Code, the Contractor shall obtain the approval and acceptance of the Engineer in advance of the excavation of any trench or trenches, jacking or

receiving pits, or sump pump pits, five feet (5') or more in depth, of the detailed approved Construction Drawings showing the design of shoring, bracing, sloping, or other provisions to be made by the Contractor for worker protection from the hazard of caving ground during the excavation of such trenches or pits, and during any other period that workers may be exposed to such hazard. If such plan varies from the shoring system standards established by the Division of Industrial Safety, the plan shall be prepared by a Registered Civil or Structural Engineer.

The requirements as above set forth by the State Division of Industrial Safety for the provision of work protection from the hazard of caving ground are minimum requirements. In addition, the Contractor shall provide, for the life of the contract, the same protection for any person, including the Engineer or any of his authorized representatives, subcontractors, or any other person required to be exposed to such hazard in the performance of the work, inspection of the work, or any other reason. The Contractor's attention is also directed to Section 12.05 of these Standard Specifications as it applies to excavation.

Payment for work protection from caving ground in excavations during construction shall be made at the lump sum price, and no additional compensation will be made therefore. Payment shall include all materials, labor and equipment necessary to adequately brace, shore, shield or slope all excavations and trenches required by the California Labor Code Section 6705. Also included are any costs incurred by the Contractor in preparing 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 excavation of the trenches.

7.20 ASSIGNMENT OF CONTRACT

The Contractor shall not assign this contract, or any part thereof, without the approval of the City, not without the consent of surety unless the surety has waived its rights to notice of assignment. All assignments of funds are subject to the prior lien for services rendered or materials supplied for the performance of the work called for in favor of all persons, forms or corporations rendering such services or supplying materials.

7.21 AMENDMENTS TO CONTRACT

Each and every provisions of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and this contract shall be read and enforced as though it were included herein, and if through mere mistake, or otherwise, any such provision is not inserted, or is not correctly inserted, then upon the application of either party hereto, the contract shall forthwith be physically amended to make such insertion.

7.22 TERMINATION OR MODIFICATION OF CONTRACT, ENVIRONMENTAL REASONS

City may terminate, amend or modify the contract for environmental considerations. In the event of such termination, modifications or amendment, the notification to the Contractor

thereof will include a statement of the compensation payable, if any, by reason of such termination, modification or amendment. The provisions of Section 9.05 of these Standard Specifications shall apply to the filing and determination of any claim or claims of Contractor in connection with such termination, modification or amendment. In the event of termination, the thirty (30) day period therein referred to shall commence to run from the date of the notification of termination.

7.23 CITY'S RIGHT TO WITHHOLD PAYMENT

The City may withhold or nullify the whole or any part of any partial or final payment to such extent as may reasonably be necessary to protect the City from loss on account of:

a. Defective work not remedied, irrespective of when any such work be defective.

b. Claims or liens filed or reasonable evidence indicating probable filing of claims or liens.

c. Failure of the Contractor to make payments properly for labor, material, equipment, or other facilities, or to subcontractors.

d. A reasonable doubt that the work can be completed for the balance unearned.

Whenever the City shall, in accordance herewith, withhold any monies otherwise due the Contractor, written notice of the amount withheld and the reason therefore shall be given to the Contractor. When the Contractor shall remove the grounds for such withholding, the City shall promptly pay to the Contractor the amount withheld.

7.24 PROPERTY RIGHTS OF MATERIALS

Nothing in the contract shall be construed as vesting in the Contractor any right of property in the materials used after they have been attached or affixed to the work or the soil, or after payment has been made for ninety percent (90%) of the value of materials delivered to the site of the work, or stored subject to or under the control of the City. All such materials shall become the property of the City upon so being attached or affixed or upon payment of ninety percent (90%) of the value of the materials delivered to the site of the work or stored subject to or under the control of the City.

7.25 RIGHTS IN LAND AND IMPROVEMENTS

Nothing in these Standard Specifications shall be construed as allowing the Contractor to make any arrangements with any person to permit occupancy or use of any land, structure, or building within the limits of the contract for any purpose whatsoever, either with or without compensation, in conflict with any agreement between the City and Owner, former Owner, or tenant of such land, structure or building.

The Contractor shall not occupy property outside the right of way as shown in the approved Construction Drawings or maps unless he enters into a rental agreement with the Owner. The agreement will be based on the fair rental values.

7.26 ACCEPTANCE OF CONTRACT

When the Engineer has made the final inspection and determines that the contract has been completed in all respects in accordance with the approved Construction Drawings, these Standard Specifications and the Special Provisions, the City Council, through the City Clerk, will issue a "Notice of Completion" of the contract, and immediately upon and after issuance of said "Notice of Completion", unless otherwise provided in the Special Provisions, the Contractor will be relieved of the duty of maintaining and protecting the work as a whole, will not be required to perform any further work thereon, and will be relieved of his responsibility for injury to persons or property or damage to the work which occurs after the formal acceptance by the City Council.

7.27 FINAL PAYMENT TO RELEASE THE CITY

The acceptance by the Contractor of the final payment shall be and shall operate as a release to the City of all claims and all liability, to the Contractor for all things done or performed for or relating to the work, and for every act and neglect of the City and others relating to or arising out of the work, excepting only his claims, if any, for amounts withheld by the City, upon final payment. No payment, however final or otherwise, shall operate to release the Contractor nor his Sureties from any obligation upon or under this contract of the Contractor's bond.

SECTION 8 - PROGRESS AND PROSECUTION

8.01 SUBCONTRACTORS

The Contractor shall indicate on the proposal form if provision is made thereon, or as soon as practicable after the signature of the contract, notify the Engineer in writing of, the names of subcontractors proposed for the work and shall not employ any that the Engineer may, within a reasonable time object to, as incompetent or unfit. Any substitution of subcontractors shall be submitted in writing to the City Engineer for his review and approval.

The Contractor agrees that he is fully responsible to the City for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

Nothing contained in the Contract Document shall create any contractual relation between any subcontractor and the City.

The purchase of concrete, liquid asphalt, paving asphalt, pipelines, valves, fire hydrants, casing, or any other materials produced at and supplied from established and recognized commercial plants together with delivery of such materials to the site of the work by means of vehicles owned or operated by such plants, or by recognized commercial hauling companies, shall not be considered as subcontracting under these Standard Specifications.

8.02 COMMENCEMENT OF THE WORK

Unless otherwise provided in the Special Provisions for a project, the Contractor shall commence work under the contract within fifteen (15) calendar days after issuance of the "Notice to Proceed" and shall diligently prosecute the same to completion within the time limit provided in the Special Provisions. Should the Contractor begin work in advance of receiving the "Notice to Proceed", as above provided, any work performed by him in advance of said date of approval shall be considered as having been done by him at his own risk and as a volunteer unless said contract is approved.

8.03 PROGRESS OF THE WORK

The Contractor shall notify the Engineer forty-eight (48) hours prior to beginning any work and in accordance with Section 5.10 of these Standard Specifications the Contractor shall submit for the Engineer's approval a schedule of operations at the time notification of commencement of work is given.

8.04 CLEAN-UP DURING CONSTRUCTION

Clean-up during construction shall include, but not be limited to, the removal of all excess soil and other materials or debris from the construction area, and sweeping and cleaning affected streets, and shall be accomplished as soon as practicable and as public necessity and convenience require, as determined by the Engineer.

Failure to comply with the time requirements set forth by the Engineer shall be sufficient

cause for the Engineer to temporarily suspend any portion of the work, or all work, until deficiencies are corrected, in accordance with Section 8.07 of these Standard Specifications.

Haul roads to and from excavation sites shall be cleaned and swept periodically during hauling operations. The Engineer may specify, whenever conditions warrant, the intervals at which cleaning and sweeping shall occur. Such prescribed intervals may vary between daily cleaning to weekly cleaning, as conditions may warrant.

No separate payment for clean-up during construction shall be made, and full compensation therefore shall be considered to be included in the various contract bid items of work.

8.05 FINAL CLEAN-UP

The Contractor shall clean-up and dispose of all excess materials and other debris in any right of way or ground occupied by him, and shall restore utilities and improvements on public or private property which have been damaged by his operations except for such items as have been specifically excepted in these Standard Specifications. The paved or oiled roadway in the work area shall be swept clean of dirt and debris upon completion of the work.

Should the Engineer determine that the Contractor or a Developer's Contractor is not diligently carrying out the required clean-up operations, the Engineer shall, in writing, notify the Contractor or Developer of the determination. The notification shall state the final date upon which the clean-up shall be completed and if the clean-up is not complete, the Engineer shall have the authority to order the work done by City forces and the cost thereof shall be deducted from any monies owed by Contractor or shall be levied as a fine against the Contractor.

Full compensation for final clean-up shall be included in the price bid for the various items of work, and no separate payment will be made therefore unless otherwise specified in the Special Provisions.

8.06 CHARACTER OF WORKMEN

If any subcontractor or person employed by the Contractor shall fail or refuse to carry out the directions of the Engineer or shall appear to the Engineer to be incompetent or to act in a disorderly or improper manner, he shall be discharged immediately on the requisition of the Engineer, and such person shall not again be employed on the work.

8.07 TEMPORARY SUSPENSION OF WORK

The Engineer shall have the authority to suspend the work wholly or in part, for such period as he may deem necessary, due to unsuitable weather, or to such other conditions as are considered unfavorable for the suitable prosecution of the work, or for such time as he may deem necessary, due to the failure on the part of the Contractor to carry out orders given, or to perform any provisions of the work. The Contractor shall immediately obey such order of the Engineer and shall not resume the work until the conditions are favorable and methods are corrected, as ordered or approved in writing by the Engineer.

Should the Contractor continue working after receiving a written order from the Engineer to suspend such work, no payment will be made to the Contractor for that portion of the work performed during such suspension.

Should the Contractor temporarily suspend work for any reason for a period of twenty-four (24) hours or more, exclusive of Saturdays, Sundays or Holidays, he shall notify the Engineer twenty-four (24) hours in advance of reinstituting any construction activity.

8.08 TIME OF COMPLETION AND LIQUIDATED DAMAGES

It is agreed by the parties to the contract that in case all the work called for under the contract is not completed before or upon expiration of the limit as set forth in the Special Provisions, damage will be sustained by the City, and that it is and will be impracticable to determine the actual damage which the City will sustain in the event of and by reason of such delay; and it is therefore agreed that the Contractor will pay to the City the sum of five hundred dollars ($500.00) per day for each and every day delayed beyond the time prescribed to complete the work; and the Contractor agrees to pay such liquidated damages as herein provided, and in case the same are not paid, agrees that the City may deduct the amount thereof from any money due or that may become due the Contractor under the contract. It is further agreed that in case the work called for under the contract is not finished and completed in all parts and requirements within the specified time, the City shall have the right to extend the time for completion or not, as may seem best to serve the interest of the City; and if the City decides to extend the time limit for the completion of the contract; the City shall further have the right to charge the Contractor, his heirs, assigns or sureties, and to deduct from the final payment for the work, all or in any part, as the City may deem proper, of the actual cost of engineering, inspection, superintending, and any overhead expense which are directly chargeable to the contract, and which accrue during the period of such extension, except that the cost of final surveys and preparation of final estimate shall not be included in such charges.

The Contractor shall not be assessed with liquidated damages nor the cost of engineering and inspection during any delay in the completion of the work caused by an act of God or of the public enemy, acts of the City, fire, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather or delays of subcontractors due to such causes; provided, that the Contractor shall, within ten (10) days from the beginning of such delay notify the Engineer in writing of the causes of the delay, and his finding of the facts thereon shall be final and conclusive.

8.09 USE OF COMPLETED PORTIONS

The City shall have the right to take possession of, use, or maintain and protect any completed portions of the work, however, taking possession, use, or maintenance and protection shall not be deemed an acceptance of any work not completed in accordance with the contract documents.

8.10 TERMINATION OF CONTRACT

If the Contractor should be adjudged as bankrupt, or if he makes a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he or any of his subcontractors should persistently violate any of the provisions of the contract, or if he should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough skilled workmen or proper materials, or if he should fail to make prompt payment to the subcontractors or for materials or labor, or persistently disregard laws, ordinances or the instructions of the Engineer, then the City may, upon certificate of the Engineer when sufficient cause exists to justify such action, serve written notice upon the Contractor and his surety of its intention to terminate the contract, and unless within five (5) days after the serving of such notice, such violations shall cease and terminate.

In the event of such termination, the City shall immediately serve written notice thereof upon the surety and the Contractor, and the surety shall have the right to take over and perform the contract, provided, however, that if the surety within ten (10) days after the serving of the notice of termination does not give the City written notice of its intention to take over and perform the contract or does not commence performance thereof within the ten (10) days stated above from the date of serving of such notice, the City may take over the work and prosecute the same to completion by contract or by any other method it may deem advisable, for the account and at the expense of the Contractor, and the Contractor and the surety shall be liable to the City for any excess cost occasioned the City thereby, and in such event the City may, without liability for so doing, take possession of and utilize in completing the work such materials, appliances, plant and other property belonging to the Contractor as may be on the site of the work and necessary therefore, In such case the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the contract price shall exceed the expenses of finishing the work, including compensation for additional managerial and administration services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the City. The expense incurred by the City, as herein provided, and damage incurred through the Contractor's default, shall be certified by the Engineer.

SECTION 9 - MEASUREMENT AND PAYMENT

9.01 COST BREAKDOWN

Upon request of the Engineer, the Contractor shall submit in a form acceptable to the Engineer, a schedule showing the subdivision of his contract into its various parts, stating quantities and prices for each item, to be made a basis for checking or computing monthly estimates, if such payments are specified. The prices shall include all costs of each item. No payment will be made to the Contractor until such schedule has been submitted to and approved by the Engineer, if required by him.

9.02 CERTIFIED WEIGHTS

When payment is to be made on the basis of weight, the weighing shall be done on certified platform scales or, when approved by the Engineer, on a completely automated weighing and recording system and in accordance with Section 9 of the State of California Standard Specifications.

The Contractor shall furnish the Engineer with duplicate licensed weighmaster's certificates showing the actual weights. The City will accept the certificates as evidence of the weights delivered.

9.03 FULL COMPENSATION INCLUDED IN BID AMOUNT

The lump sums and/or unit prices shown in the proposal shall include full compensation for all work and expenses appurtenant to the accomplishment of the project described in these Standard Specifications in the manner indicated herein including, but not limited to, all items delineated in these contract documents for which specific bid items are not set up in the Proposal.

9.04 EXTRA WORK

Extra work, when ordered and accepted, shall be paid for under a written work order in accordance with the terms therein provided. Payment for extra work will be made at the unit price or lump sum price previously agreed upon by the Contractor and the Engineer and approved by the City.

When extra work is to be paid for on a force account basis, the Contractor shall receive actual cost of all materials furnished by him as shown by his paid vouchers, plus fifteen percent (15%), and for all labor for the said extra work he shall receive the actual wages paid in the accomplishment of said work, the rates for which shall have been previously determined and agreed to in writing by the Engineer and by the Contractor plus fifteen percent (15%). The price paid for labor by the Contractor shall include all payments imposed by State and Federal laws. The Contractor will be paid for the use of equipment at the rental rates listed for such equipment in the Department of Transportation publication entitled "Labor Surcharge and Equipment Rental Rates": which is in effect on the date upon which work is accomplished regardless of ownership of such equipment and any rental or other agreement, if such may exist, for use of such equipment entered into by the Contractor. Said publication is hereby

made a part of these Standard Specifications. If it is deemed necessary by the Engineer to use equipment unlisted in the said publication, a suitable rental rate for such equipment will be established by the Engineer. The Contractor may furnish any cost data which might assist the Engineer in the establishment of such rental rate. The rental rates paid as above provided shall include the cost of fuel, oil, lubrication supplies and small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, and all incidentals. To the equipment rental rate thus established shall be added the amount of fifteen percent (15%).

The Contractor shall maintain his records in such a manner as to provide a clear distinction between the direct costs of extra work paid for on a force account basis and the costs of other operations.

The Contractor shall furnish the Engineer report sheets in duplicate of each day's extra work paid for on a force account basis no later than the working day following the performance of said work. The daily report sheets shall itemize the materials used, and shall cover the direct cost of labor and the charges for equipment rental, whether furnished by the Contractor, subcontractor, or other forces. The daily report sheet shall provide names or identifications and classifications of workmen, the hourly rate of pay and hours worked, and also the size, type and identification number of equipment and hours operated.

Material charges shall be substantiated by valid copies of vendor's invoices. Such invoices shall be submitted with the daily report sheets, if available. Said daily report sheets shall be signed by the Contractor or his authorized agent.

The Engineer will compare his records with the daily report sheets furnished by the Contractor, make any necessary adjustment, and compile the costs of work to be paid for on a force account basis. The Compilation, when agreed upon and signed by both parties, shall become the basis of payment for the work performed.

Payment as provided above shall constitute full compensation for the Contractor for performance of work paid for on a force account basis, and no additional compensation will be allowed therefore.

9.05 NOTICE OF POTENTIAL CLAIM

The Contractor shall not be entitled to the payment of any additional compensation for any act or failure to act by the Engineer including failure or refusal to issue a change order, or for the happening of any event, thing, occurrence, or other cause unless he shall have given the Engineer due written notice of potential claim as hereinafter specified.

The written notice of potential claim shall set forth the reasons for which the Contractor believes additional compensation will or may be due, the nature of costs involved, and, in so far as possible, the amount of the potential claim. The said notice as above required must have been given to the Engineer prior to the time that the Contractor shall have performed the work giving rise to the potential claim for additional compensation.

It is the intention of this Section, that differences between the parties arising under and by virtue of the contract, be brought to the attention of the Engineer at the earliest possible time in order that such matters may be settled, if possible, or other appropriate action promptly

taken. The Contractor hereby agrees that he shall have no right to additional compensation for claim that may be based on any such act, failure to act, event, thing, or occurrence, for which no written notice of potential claim as herein required was filed.

9.06 PROGRESS PAYMENTS

The Contractor shall, once each month, cause an estimate in writing to be made of the total amount of the work done and acceptable material furnished and delivered by the Contractor on the ground and not used, or acceptable materials furnished and stored for use on the contract, if such storage is within the limits of the project, and is subject to or under the control of the City at the time of such estimate, and the value thereof. Such estimate shall be submitted to the Engineer for his review ten (10) days in advance of the date of the City Council meeting at which payment will be authorized. The Engineer shall have the authority to adjust the items as submitted on the estimate in accordance with his judgement of the amount of work performed or materials on hand.

The City shall retain ten percent (10%) of the value of the materials so estimated to have been furnished and delivered and unused or furnished and stored as afore-mentioned as part security for the fulfillment of the contract by the Contractor. The City shall also retain ten percent (10%) of the value of all work done from each monthly payment. In accordance with the provisions of California Government Code Section 4590, substitution of securities may be made for any monies withheld by the City to insure performance under this contract. At the request and expense of the Contractor, securities equivalent to the amount withheld pursuant to this Section shall be deposited with the City or with a State or Federally chartered bank as the escrow agent, who shall pay such monies to the Contractor upon satisfactory completion of the contract and the expiration of the specified time following recordation of the "Notice of Completion" as set forth in these Standard Specifications or the Special Provisions during which said amounts are subject to lien by labor and materials suppliers. Securities eligible for investment under this Section shall include those listed in California Government Code Section 16430, or bank or savings and loan certificates of deposit. The Contractor shall be the beneficial Owner of any securities substituted for monies withheld and shall receive the interest thereon.

The City shall pay monthly to the Contractor while carrying on the work the balance not retained, as aforesaid, after deducting there from all previous payments and all sums to be kept or retained under the provisions of the contract. No such estimate or payment shall be required to be made when, in the judgment of the Engineer, the work is not proceeding in accordance with the provisions of the contract, or when, in his judgment, the total value of the work done since the last estimate amounts to less than three hundred dollars ($300.00).

No such estimate or payment shall be considered to be an acceptance of any defective work or improper materials.

The Contractor shall request such payment on a form approved by the Engineer which shall be properly completed and executed.

The estimated value of the work shall in no case exceed the price for the contract item of work in which the material is to be incorporated.

9.07 FINAL PAYMENT

The Engineer shall, after the completion of the contract, make a final estimate of the amount of work done there under, and the value of such work, and the City shall pay the entire sum so found to be due after deducting there from ten percent (10%) of the final estimate to be retained following final acceptance of the work. The final retained payment shall not be due and payable until the expiration of thirty-five (35) days from the date of recordation of the "Notice of Completion".

It is mutually agreed between the parties to the contract that no certificate given or payments made under the contract, except the final certificate or final payment, shall be conclusive evidence of the performance of the contract, either wholly or in part, and no payment shall be construed to be an acceptance of any defective work or improper materials.

And the Contractor further agrees that the payment of the final amount due under the contract, and the adjustment and payment for any work done in accordance with any alterations of the same, shall release the City, the City Council, and the Engineer from any and all claims or liability on account of work performed under the contract or any alteration therefore.

SECTION 10 - PORTLAND CEMENT CONCRETE, CEMENT MORTAR

10.01 DESCRIPTION

Portland Cement Concrete shall be composed of Portland Cement, fine aggregate, coarse aggregate and water, portioned and mixed as specified a combination of "Type II Modified" Portland Cement and mineral and mixture in Section 90, of the State of California Standard Specifications.

a. Class 2: Concrete shall contain five hundred ninety pounds (590 lbs, or 6 sacks) of Portland Cement per cubic yard with one inch (1") aggregate. Five inch (5") maximum slump. Three thousand pounds per square inch (3,000 psi) at twenty-eight (28) days for design purpose only.

b. Class 3: Concrete shall contain five hundred five pounds (505 lbs, or 5 sacks) of Portland Cement per cubic yard with one inch (1") aggregate. Five inch (5") maximum slump. Two thousand five hundred pounds per square inch (2,500 psi) at twenty-eight (28) days for design purpose only.

c. Class 4: Concrete shall contain four hundred twenty pounds (420 lbs, or 4 sacks) of Portland Cement per cubic yard with one inch (1") aggregate. Five inch (5") maximum slump. Two thousand five hundred pounds per square inch (2,500 psi) at twenty-eight (28) days for design purpose only.

The Class and minimum compressive strength of concrete shall be Class 3 or as required in these Standard Specifications for the items of work requiring Portland Cement Concrete.

10.02 MATERIALS

The materials for manufacturing Portland Cement Concrete shall conform to the following requirements:

a. Portland Cement, including Portland Cement used in precast products, shall be Type II cement conforming to the Specifications of ASTM Designation: C150, unless otherwise specified.

The Contractor shall make arrangements with the manufacturer of ready mixed concrete, or precast products to provide adequate facilities to assure that cement meeting the requirements specified herein will be kept separate from other cement in order to prevent any but specified cement from entering the work.

All cement not conforming to these Standard Specifications and all cement contaminated shall be removed immediately and not used in the work.

Water for washing aggregates and for mixing with concrete shall be free from oil or other impurities in sufficient amount to cause a significant change in the true setting, reduction in the compressive strength, discoloration of the concrete, or etching of the surface.

Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, or combination thereof. It shall be free from deleterious coatings, roots, barks, sticks, rags and other extraneous

materials.

Regardless of source, all coarse aggregate shall be thoroughly and uniformly washed before delivery to the work.

Coarse aggregate, when sampled at the batching bin, shall have a cleanness value of not less than eighty-two (82) when subjected to the cleanness test performed in accordance with Test Method No. California 227.

Coarse aggregates shall be furnished in the following sizes determined in accordance with ASTM Designation: C136, as follows:

Percentage of Aggregate Passing Through Sieve

	Aggregate Size		
Sieve Size	1-1/2" to #4	1" to #4	3/4" to #4
2"	100		
1 - 1/2"	90 – 100	100	
1"	20 – 55	90 - 100	100
3/4"	0 – 15	60 - 95	90 - 100
3/8"	10 – 30	15 - 40	20 - 55
#4	0 – 5	0 - 10	0 - 10

The maximum size of coarse aggregate shall be as required in these Standard Specifications for the items of work requiring Portland Cement Concrete.

Coarse aggregate, when tested for soundness by the sodium sulphate test, ASTM Designation: C88, shall lose not more than ten percent (10%) by weight after five (5) cycles.

Fine aggregate shall be natural sand, or a combination of natural and manufactured sand. The aggregate shall be of such character that makes possible the production of a workable concrete within the limits of water content provided in Section 10.05 of these Standard Specifications. It shall be free from deleterious coatings, roots, barks, sticks, rags, and other extraneous material.

When testing in accordance with the test method of ASTM Designation: C40, fine aggregate shall not indicate a color darker than the reference standard color solution unless it is determined by the Engineer that a darker color is acceptable.

The fine aggregate shall contain not more than three percent (3%) by weight of materials passing the two hundred (200) mesh screen when tested in accordance with the test method of ASTM Designation: C136.

Fine aggregate shall be well graded and shall range in size uniformly within the following limits when tested in accordance with ASTM Test Method Designation: C136.

Sieve Size	Percentage Passing Sieves
3/8”	100
#4	90 - 100
8	65 - 90
16	45 - 75
30	20 - 45
50	10 - 20
100	0 - 8

10.03 READY MIXED CONCRETE

Ready mixed concrete shall be delivered to the job site of the work and discharge shall be completed within one and one-half (1½) hours after the addition of the cement to the aggregates or before the drum has been revolved two hundred fifty (250) revolutions, whichever comes first. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall be less than one and one-half (1½) hours, as directed by the Engineer, except that concrete shall not be discharged once the temperature of the concrete has reached eighty-five degrees Fahrenheit (85° F).

Should water be added at the job site, the drum shall be revolved a minimum of twenty-five (25) revolutions after the introduction of such water.

The maximum size of coarse aggregate shall be as required in these Standard Specifications for the items of work requiring Portland Cement Concrete.

10.04 ADMIXTURES

No admixture shall be used without written permission from the Engineer or unless elsewhere provided for in these Standard Specifications or in the Special Provisions.

a. Calcium Chloride: When the use of calcium chloride is permitted or is specified in the Special Provisions, the calcium chloride shall conform to the specifications of ASTM Designation: D98.

b. Air-Entraining Agent: When the use of an air-entraining agent is permitted, or is specified in the Special Provisions, it shall be added at the rate designated by the Engineer to result in an air content of from three percent to six percent (3%-6%) by volume in the freshly mixed concrete.

10.05 AMOUNT OF WATER AND SLUMP TEST

The amount of water required for the proper consistency of concrete shall be determined by means of the Slump Test made in accordance with the Standard Method of Slump Test for

Consistency of Portland Cement Concrete of the AASHO Serial Designation: T-1 19-42 with subsequent amendments.

The amount of slump shall be twelve inches (12") minus the height after subsidence. The allowance for slump shall be as follows:

a. Cast-in-place pipe and concrete paving - not more than three inches (3").

b. All concrete structures - not more than three inches (3").

c. Concrete curbs, gutters and sidewalks - not more than five inches (5").

The amount of water used shall not exceed six and one-half gallons (6½ gal.) including moisture in the aggregate, per sack of cement for Class 2 concrete, and seven gallons (7gal.) per sack of cement for Class 3 concrete.

10.06 PROTECTING CONCRETE

Concrete for structures shall not be placed on frozen ground nor shall it be mixed or placed while the atmospheric temperature is below thirty-five degrees Fahrenheit (35° F), unless adequate means are employed to heat the aggregates and water, and satisfactory provisions have been made for protecting the work. Provisions satisfactory to the Engineer shall be taken to protect concrete about to be poured when there is danger of temperature dropping below thirty-five degrees Fahrenheit (35° F) within the next twenty-four (24) hours. Concrete damaged by frost action shall be replaced by the Contractor at his expense. Concrete shall not be placed when the atmospheric temperature in the shade in the vicinity of the work exceeds ninety-five degrees Fahrenheit (95° F), or when the temperature of the concrete exceeds eight-five degrees Fahrenheit (85° F).

All surfaces against which concrete is to be placed shall be free from standing water, mud, debris, and shall be firm enough to prevent contamination of the concrete by earth or other foreign material.

Absorptive surfaces against which concrete is to be placed shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete.

10.07 FORMS

Forms shall be smooth, mortar right, true to the required lines and grades, and of sufficient strength to resist springing out of shape during the placing of the concrete. All dirt, chips, sawdust, nails, and other foreign matter shall be completely removed from the forms before any concrete is deposited therein. Forms previously used shall be thoroughly cleaned of all dirt, mortar, and foreign matter before being reused. Before concrete is placed in forms, all surfaces against which the concrete will be placed shall be thoroughly coated with form oil.

Prior to placing concrete, the Contractor shall have all forms checked by the Engineer for alignment and grade. Forms, reinforcing steel, or earth surfaces to receive concrete shall be wet prior to concrete placement.

10.08 CURING CONCRETE

When maximum daytime temperature exceeds fifty degrees Fahrenheit (50° F) all newly placed concrete shall be sprayed uniformly with a curing compound. Curing compound shall be applied at a nominal rate of one gallon per one hundred fifty square feet (1 gal/150 ft²), unless otherwise specified. Immediately after finishing, the exposed exterior surfaces of the concrete shall be cured by either the water method, pigmented curing compound method, or the waterproof membrane method, in accordance with Section 90-7, "Curing Concrete" of the State of California Standard Specifications, except that for cast-in-place concrete pipe only the waterproof membrane method shall be used as provided in Section 17.05.i of these Standard Specifications.

10.09 VIBRATOR

Whenever a structure requiring reinforcement is to be constructed, the Contractor shall provide one (1) or more portable vibrating machines to be used on such structures as directed by the Engineer. Full compensation for providing vibrating machines shall be considered as being included in the various bid items of work and no additional payment will be made therefore.

10.10 CEMENT MORTAR

Cement mortar shall be composed of one (1) part Portland Cement and two (2) parts of clean, well-graded sand of such a size that it will pass a number eight (#8) sieve. An admixture of hydrated lime, fire clay or diatomaceous earth may be used in the mortar to facilitate workability, and the amount of such material used will be limited as ordered by the Engineer. Quick setting cement may be used when necessary to facilitate the early backfilling of trench.

No mortar shall be used in which water has been added to the dry ingredients for a period of over thirty (30) minutes.

The consistency of mortar shall be such as to adhere to the ends of the pipe while being laid and be easily squeezed out of the joint when the pipe sections are squeezed together. Jointing and banding mortar shall be of such consistency that it will readily adhere to the pipe and/or structure.

10.11 CEMENT REQUIREMENTS

Concrete compressive strength requirements shall be the minimum strength at the age of twenty-eight (28) days as required in these Standard Specifications for the items of work requiring Portland Cement Concrete. The compressive strength of concrete will be determined from test cylinders which have been fabricated from concrete sampled and made in accordance with these Standard Specifications and with ASTM Designation: C3 1. Cylinders shall be tested in accordance with ASTM Designation: C39. Should the concrete used in the work fail to meet the minimum strength requirements as specified for the items of work, the Contractor shall, at his expense, make corrective changes in the material mix proportions or in

the concrete fabrication procedures, before placing additional concrete.

In addition to the aforementioned requirements, all such concrete represented by test cylinders which indicate a strength of less than the specified strength for the item of work will be rejected in accordance with the provisions of Section 6.04, "Defective Materials" of these Standard Specifications. Such rejection shall prevail unless the Contractor, at his expense, obtains and submits evidence of a type acceptable to the Engineer that the strength and quality of the concrete placed in the work are acceptable, or undertakes remedial action to correct the deficiency in a manner acceptable to the Engineer.

10.12 MEASUREMENT AND PAYMENT

Portland Cement Concrete will be measured and paid for in accordance with the provisions specified in the various sections of these Standard Specifications or the Special Provisions covering construction requiring concrete. Full compensation for cement mortar shall be considered as included in the bid items of work requiring the use therefore.

SECTION 11 - CLEARING AND GRUBBING

11.01 DESCRIPTION

This work shall consist of removing all objectionable material from within the street or alley right of way, along the site of pipeline construction or fence construction, and such other areas as may be designated in the approved Construction Drawings or the Special Provisions to be cleared and grubbed. Clearing and grubbing operations shall be performed in advance of construction operations and in accordance with these Standard Specifications and with the appropriate sections of the State of California Standard Specifications.

11.02 PROTECTION OF EXISTING IMPROVEMENTS

The Contractor's attention is directed to Section 7.13, "Preservation of Property" of these Standard Specifications. Only those items or areas designated or marked shall be removed or cleared.

11.03 CONSTRUCTION

Clearing and grubbing shall conform to the provisions in Section 16 of the State of California Standard Specifications and these Standards Specifications.

Unless otherwise specified, the entire area within the project limits shall be cleared and grubbed. No payment will be made to the Contractor for clearing and grubbing outside these limits, unless such work is authorized by the Engineer.

All of the work shown in the approved Construction Drawings and included in these Standard Specifications and the Special Provisions that is located in the public streets in the City of Visalia, shall be done in accordance with City Ordinances regulating the use of public streets within the City, except as otherwise provided herein. (See Title 10, Chapter 8, City of Visalia, California Municipal Code.)

The Contractor shall inform himself as to all regulations and requirements of the City of Visalia and shall conduct his operations in compliance therewith.

The Contractor shall remove and dispose of all pavement, vegetation growth, such as brush, trees, stumps, roots, grass, and all rubbish, debris, or structures from the work site or other areas designated to be cleared and grubbed. No such material will be allowed in or under backfill material or embankments. Trees and other vegetation not to be removed shall be protected from damage in accordance with Section 7.12 of these Standard Specifications.

Within the limits of clearing, all stumps, large roots, buried logs, and all other organic material shall be removed three feet (3') below the existing ground surface or six feet (6') below finished grade, whichever is deeper.

Concrete removal shall conform to the provisions in Section 15 of the State of California Standard Specifications and these Standard Specifications. Where a portion of an existing concrete facility is to be removed, it shall be cut to a minimum depth of one and one-half inches (1½") with an abrasive type saw at the first scoring line at, or outside, the planed joint

and removed without damage to any portion that is to remain in place. If curbs and gutters cannot be cut off square and neat, the entire curb and gutter shall be removed to the nearest weakened plane or expansion joint. No patching at expansion joints will be permitted.

All concrete (Portland or Asphalt) and oil dirt within the right of way shall be removed by the Contractor unless designated to remain on the approved Construction Drawings. Existing drain wells, drainage structure, irrigation lines, structures and headwalls to be abandoned shall be removed to at least two feet (2') below the surface and backfilled. Manholes to be abandoned shall be abandoned as specified in Section 19.02.e of these Standard Specifications.

Where existing house foundations and floor slabs overlap into the project area, the whole foundation will be removed. The portion beyond and outside the project area will be considered within the project area and included in the bid price of removing concrete.

Tree branches extending over the roadway which interfere with the work shall be trimmed by the City at the request of the Contractor upon forty-eight (48) hours prior notice to the time such removal is required.

11.04 REMOVAL AND DISPOSAL OF MATERIALS

Disposal of removed material shall be done in accordance with the State of California Standard Specifications, Section 7-1.13 and the Special Provisions.

Compensation for all costs involved in disposing of materials as specified including all costs of hauling shall be included in the payment for clearing and grubbing as stated herein or in the Special Provisions and no additional payment will be made therefore.

11.05 PAYMENT

Where a contract item is provided, clearing and grubbing will be paid for on a lump sum basis. Where no contract item is provided, the cost for clearing and grubbing shall be included in the various bid items requiring clearing and grubbing or as set forth in the Special Provisions and no additional payment will be made therefore.

The lump sum price paid, or the price paid when included with other items, for clearing and grubbing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in clearing and grubbing as shown on the approved Construction Drawings, as specified in these Standard Specifications, or the Special Provisions, and as directed by the Engineer, including the removal and disposal of all the resulting materials.

SECTION 12 - EARTHWORK

12.01 DESCRIPTION

This work shall consist of performing all excavation and/or placing compacted fill to prepare the roadway prism and area adjacent thereto for the placement of improvements as shown in the approved Construction Drawings. The work shall also include any excavation and backfilling required to install structures, sewer pipelines, storm drain pipelines, water lines, and other underground conduits, and their appurtenances at the locations and to the lines and grades as shown in the approved Construction Drawings, as shown in the Engineering Improvement Standards, and as specified in these Standard Specifications, the Special Provisions, in conformance with Section 19 of the State of California Standard Specifications and as directed by the Engineer.

12.02 PRESERVATION OF PROPERTY

The Contractor's attention is directed to Section 7.13 of these Standard Specifications regarding preservation of existing improvements and utilities.

Prior to starting excavation and subgrade preparation, the Contractor shall lower all existing manholes and water valve casings and lids to a depth of six inches (6") below the finish elevation of the subgrade.

All frames and lids for manholes and water valves shall be inspected by the Engineer and judged as to their suitability for reuse on the job. If they are found unsuitable, they shall be salvaged in accordance with Section 6.06 of these Standard Specifications. New lids and frames will be supplied by the City. No additional payment will be made to the Contractor for salvaging the unsuitable frames and lids and utilizing those supplied by the City.

The existing frame and lid for manholes, if in acceptable condition, may be temporarily mortared to the existing manhole cone or the Contractor shall supply a temporary metal lid to cover the opening of the manhole and store the existing manhole frame and lid for use later to raise the manhole to grade.

Water valve casings shall be lowered to six inches (6") below the finish elevation for the subgrade and covered, if in acceptable condition, with the existing valve cover or covered with some other means acceptable to the Engineer.

Prior to covering up any manholes or water valves that have been lowered, the Contractor shall reference their locations so as to facilitate the raise of the manholes or water valves to grade at a later date.

The Contractor shall return after the final street paving has been placed and raise to grade, in accordance with Sections 13, 14, 19, and 20 of these Standard Specifications, all manholes and water valves lowered as a result of roadway excavation.

Payment for lowering, protecting and returning to raise to grade manholes and water valves shall be made on the unit price bid per each and shall include full compensation for furnishing all labor, materials, tools, equipments, and incidentals, and doing all work involved in lowering, protecting, covering, and returning to raise to grade all manhole and water valves as

shown in the approved Construction Drawings, on the Engineering Improvement Standards, and as specified in these Standard Specifications, the Special Provisions, and as directed by the Engineer.

12.03 DISPOSAL OF UNSUITABLE AND EXCESS MATERIAL

All excess and unsuitable material shall be removed and disposed of in accordance with Section 7-1.13 of the State of California Standard Specifications.

12.04 ROADWAY EXCAVATION

a. Description: Roadway excavation shall consist of all excavation involved in the grading and construction of roadway improvements, including paving, concrete curbs and gutters, sidewalks, alley approaches, driveway approaches, and valley gutters. All work shall conform to Section 19-2 of the State of California Standard Specifications and these Standard Specifications.

b. Compaction: Relative compaction within the public right of way shall be determined by Test Method California No. 216.

   Compactive effort shall be applied to all areas where pavement or concrete improvements are to be placed or constructed. The relative compaction under paving areas and under curb and gutter shall be ninety five percent (95%) and under sidewalks shall be ninety percent (90%) to a depth of six inches (6") below the finish grade of the subgrade in excavation. The relative compaction of all embankment material shall be ninety percent (90%).

   The cost of compaction under paving areas shall be included in the cost of roadway excavation.

   The cost of compaction under concrete improvements shall be included in the various bid items for concrete improvements.

   No compaction tests of subgrade shall be made until such time as the subgrade is finished to within one-tenth of one foot (0.1') of finished subgrade and the Engineer has been notified of the time that such compaction tests will be made. The Engineer shall specify the locations where compaction tests are to be made.

   Compaction testing shall be provided in accordance with Section 6.02 of these Standard Specifications.

c. Imported Borrow: All imported borrow shall have a minimum "R" value of fifty (50) unless the approved Construction Drawings or the Special Provisions indicate otherwise. Testing to determine the "R" value of the imported borrow shall be made in accordance with Test Method California No. 301 of the State of California Standard Specifications and shall be at the expense of the Contractor.

d. Subgrade: The preparation of subgrade for all paved areas shall conform to the

provisions of Section 19 of the State of California Standard Specifications and these Standard Specifications. Relative compaction of the subgrade shall be ninety percent (90%) as previously specified.

The subgrade shall be accurately graded and compacted to proper profile and cross-section and at elevations which will result in the proper final grades when the specified thicknesses of aggregate subbase, base, and/or paving have been applied. The finished subgrade shall not vary from the planned grade by more than five hundredths of one foot (0.05') at any point. The Contractor shall not place any aggregate subbase or base material or asphalt paving until the subgrade is in a condition satisfactory to the Engineer.

e. Miscellaneous Highway Facilities: The removing, reconstructing, adjusting, remodeling, and salvaging of the various highway facilities shall conform to the provisions in Section 15 of the State of California Standard Specifications and these Standard Specifications.

All miscellaneous highway facilities within the highway right of way noted on the approved Construction Drawings to be removed, shall be removed and disposed of by the Contractor.

f. Payment: Quantities of roadway excavation shall be paid at the contract unit price per cubic yard and shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals required to excavate, grade, and compact the subgrade and to remove, replace, adjust, remodel, and salvage any existing highway improvements designated in the Special Provisions in order to perform the required work on the subgrade and no additional payment will be made therefore.

12.05 TRENCH AND STRUCTURE EXCAVATION

a. Description: Trench and structure excavation shall consist of performing all excavation required to properly install or construct the various types of pipelines, conduits, and their appurtenant structures. All excavations shall be made in accordance with the Trench Construction Safety Orders issued by the Division of Industrial Safety of the Department of Industrial Relations of the State of California and these Standard Specifications.

b. Permits: The Contractor shall obtain permits from the State Division of Industrial Safety or any other permit that may be required by the work or as required by law, prior to commencing any excavation within the street, with no additional compensation therefore.

c. Trench and Structure Excavation: Excavations shall be made to the depths and widths required to accommodate construction of pipelines and structures to specified dimensions, and to the lines and grades indicated in the approved Construction Drawings and, in the case of sewer and water house branches, in accordance with the Engineering Improvement Standards. Storm drain laterals, (pipelines that connect the storm drain inlet to the main storm drain) shall be

installed at the depth and grade specified by the Engineer after exposing of existing intersecting utilities by the Contractor.

The location of subsurface utilities or other obstructions may necessitate a change in location or depth of the main pipeline, house service or lateral, which depth or surface location shall be determined in the field by the Engineer. Changes in main line pipe alignment either horizontally or vertically shall be paid as specified in Section 5.13.d of these Standard Specifications.

The Contractor, however, shall allow in his bid price for the various house service or lateral pipe installation quantities full compensation for any increase or decrease in anticipated depth of trench because of the location of intersecting utilities, shown on the approved Construction Drawings or not.

When a trench or structure site is to be located in an existing paved area, the existing paving to be removed shall be cut by methods approved by the Engineer along neat lines on each side of the trench or around the structure site. Existing paving at any location shall be removed from proposed trench areas or structure sites no sooner than forty-eight (48) hours prior to excavation at that location. No paving shall be removed on Friday unless excavation and follow-up work will occur the same day.

Existing paving, when removed, shall be kept separated from the material which is to be returned to the excavation. Failure to comply with this requirement shall be grounds for rejection of the material for use as backfill.

Structures and pipes shall be constructed or placed as soon as practicable after excavation, but in no case shall a trench be excavated more than sixteen (16) hours before pipe construction. No trench shall be excavated on Friday that is not to receive pipe on the same day.

Not more than six hundred linear feet (600') of trench shall be open ahead of any storm drain, sewer water pipeline, or any conduit in any street or alley, except that upon written permission of the City Engineer such trenches may be opened for a distance of not more than one thousand two hundred linear feet (1,200') where public traffic will not be seriously inconvenienced.

Trenches for pre-cast pipe shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe.

Trenches for cast-in-place pipe shall be graded and prepared to provide full, firm and uniform support by undisturbed earth or compacted fill throughout the bottom two hundred twenty degrees (220°) of the pipe periphery.

For pre-cast pipe trenches, if rock, hardpan or like materials are encountered, it shall be removed to a depth of six inches (6") below the grade of the bottom of the pipe. The space shall be backfilled with suitable material containing sufficient moisture to produce maximum compaction, and shall be free from lumps or other unsuitable material. The imported earth shall be compacted to the satisfaction of the Engineer, and finish graded to the original lines and grades as provided above

for pre-cast and cast-in-place pipe. No additional payment will be made for such excavation or backfill.

In all trenches or structure sites where a firm foundation is not encountered, such as soft, spongy, or otherwise, unsuitable material, the material shall be removed to a minimum of twelve inches (12"), or to a depth determined by the Engineer, below the bottom of the pipe or structure, and the space backfilled with suitable material containing sufficient moisture to produce maximum compaction. The backfill material shall be free from lumps or other unsuitable material, and when compacted to the satisfaction of the Engineer shall be finish graded as provided above for precast and cast-in-place pipe, or as required by the Engineer for structures. No additional payment will be made for such additional excavation or backfill.

All existing gas pipes, water pipes, conduits, sewers, drains, fire hydrants, and other structures which are not, in the opinion of the Engineer, required to be changed in location shall be carefully supported and protected from injury by the Contractor, and in case of injury, shall be restored by him, without additional compensation, to as good a condition as that in which they were found and to the satisfaction of the Owner and the Engineer, in accordance with Section 7.12 of these Standard Specifications.

d. Maintaining Drainage Within Trenches and Structures: Reference is made to Section 4.11 of these Standard Specifications. The Contractor shall keep trench and structure excavations as dry as practicable throughout the construction period, subject to the requirements of these Standard Specifications Section 10, "Portland Cement Concrete, Cement Mortar". Payment for cost or repair of trenches damaged because of failure to provide temporary drainage control shall be included in the various bid items of work and no additional compensation will be paid therefore.

e. Disposal of Excess Materials: The Contractor shall acquire a suitable site for the disposal of excess material, including existing paving removed for trenching operations, in accordance with Section 7-1.13 of the State of California Standard Specifications.

   Full compensation for acquiring the site and disposing of excess material shall be included in the prices paid for the various items of work requiring excavation.

f. Payment: Trench excavation and structure excavation will be paid for in accordance with the provisions specified in the various sections of these Standard Specifications covering construction requiring trench or structure excavation.

12.06 TRENCH AND STRUCTURE BACKFILL

a. Description: Trench and structure backfill shall consist of the proper backfilling of trenches and around structures after the placement or construction of the various types of pipelines, conduits and their appurtenant structures. All work shall be done in accordance with these Standard Specifications.

b. Material for Trench and Structure Backfill: Unless otherwise specified, shall be native material free from debris, lumps, hardpan chunks, paving material, organic matter or other deleterious or unsuitable substances. Backfill material shall be approved by the Engineer before being used in the work.

c. Trench Backfill (Pre-Cast Pipe): Backfill for trenches in which pre-cast pipe has been installed shall be placed in two phases, classified as Initial Backfill and Final Backfill.

Initial backfill for pipes up to and including fifteen inches (15") in inside diameter, shall consist of placing and firmly compacting by hand tamping, in six inch (6") lifts, select native material at optimum moisture under the haunches, on each side, and on the top of the pipe to an elevation of six inches (6") above the top of the pipe.

Initial backfill for pipes of inside diameter greater than fifteen inches (15") shall consist of placing and firmly compacting backfill material under the haunches of the pipe, as directed by the Engineer, so as to form a firm bedding for the pipe. The material shall be placed and compacted to a depth sufficient to prevent movement of the pipe during jointing operations or during final backfill and compaction operations.

Final backfill shall consist of placing backfill material into the remaining trench cavity following completion of initial backfill. Backfill material shall be returned to the trench in lifts not to exceed nine inches (9") in depth. Each lift shall be jetted to the bottom of the lift prior to placement of the next lift of backfill material. In no case shall backfill material be allowed to free-fall directly onto the pipe. Final backfill shall be accomplished as soon as practicable, except that for mortar joint concrete pipe final backfill shall not be placed until, in the opinion of the Engineer, the cement in the joints has acquired a suitable degree of hardness. In no case, however, shall final backfill follow initial backfill by more than twenty-four (24) hours, not initial excavation by more than forty-eight (48) hours.

At locations where traffic, safety, or other considerations warrant, the Engineer may order the immediate backfill of trenches, regardless if the pipe was installed or not. Where pipe was not installed, the trench shall not be re-excavated until provisions are made to prevent the conditions which caused the backfill to be ordered. No additional compensation will be paid for backfill and re-excavation.

d. Trench Backfill (Cast-in-Place Concrete Pipe): Backfill for trenches in which cast-in-place concrete pipe has been constructed shall consist of placing backfill material into the remaining trench cavity. Backfill shall be accomplished as soon as practicable and shall follow pipe construction by no more than two (2) working days, provided that in no case shall backfill material be placed over the pipe sooner than twenty-four (24) hours following construction of the pipe. Backfill material shall be returned to the trench in lifts not to exceed nine feet (9') in depth. Each lift shall be jetted prior to placement of the next lift of backfill material. In no case shall backfill material be allowed to free-fall directly onto the pipe.

Compaction of backfill shall conform to the requirements of Section 12.06.g of

these Standard Specifications.

e. Structure Backfill: Structure backfill shall consist of placing and compacting backfill material around structures to the lines designated in the approved Construction Drawings or directed by the Engineer.

Compaction shall conform to the requirements of Section 12.06.g of these Standard Specifications.

f. Backfilling (General): Where as excavation or trench crosses a street or alley intersection, the excavation and backfilling shall be completed within twenty-four (24) hours, or bridging capable of supporting vehicular traffic shall be provided for access across said excavation or trench.

An excavation within a street or alley for the purpose of boring or jacking pits or for the installation of structures shall be properly barricaded and protected and may be left open for a period of seven (7) days and then must be backfilled, unless an extension of time is approved by the Engineer in writing.

Within twenty-four (24) hours after the trench has been backfilled, all street crossing shall be surfaced with temporary surfacing of two inches (2") of cold mix surfacing which shall be placed and maintained as specified in Section 15.03 of these Standard Specifications. Nothing herein shall be construed to mean that permanent surfacing cannot immediately be placed provided subgrade, subbase, and base compaction requirements are satisfied.

All trenches under existing curb and gutter or other City structures shall require a slurry cement backfill of not less than one hundred eighty-eight pounds (188 lbs) of cement per cubic yard of material produced.

g. Compaction: Trench and structure backfill shall be placed and compacted in uniform layers and shall be brought up uniformly on all sides of the structure, facility, or pipe utilizing approved compaction equipment. The thickness of each layer of backfill shall not exceed sixty-seven hundredths of one foot (0.67') before compaction except that when compaction by ponding or jetting is permitted, said thickness shall not exceed four feet (4'). Compaction of trench and structure backfill may be accomplished by jetting only with prior approval of the Engineer. Such jetting, if approved, shall be supplemented by approved compaction equipment. Relative compaction of trench and structure backfill shall be determined by the laboratory standard of test procedure Test Method California No. 216. Trench or structure backfill shall have a relative compaction of not less than ninety percent (90%) to within twenty-four inches (24") of the surface, and the remaining top twenty-four inches (24") shall have a relative compaction of not less than ninety-five percent (95%), except that base material shall have a minimum relative compaction of ninety-five percent (95%).

The Contractor shall contact the Department of Public Works concerning the use of water from the City's water system for any construction activities.

Compaction for trenches in which pre-cast pipe has been placed may proceed

immediately following placement of final backfill.

Compaction for trenches in which cast-in-place pipe has been placed or excavation sites in which structures have been constructed shall proceed according to the following requirements. Jetting may proceed no sooner than forty-eight (48) hours after construction of the pipe or structure; follow-up compaction using equipment which imparts load on the pipe or structure shall not proceed for a minimum of seven (7) days following placement of the pipe or structure, unless this requirement is specifically waived by the Engineer, or is otherwise specified.

Compaction testing shall be provided as specified in Section 6.02 of these Standard Specifications.

h. Measurement and Payment: Trench and Structure backfill and compaction will be paid for in accordance with the provisions specified in the various sections of these Standard Specifications covering construction requiring trench or structure backfill.

SECTION 13 - AGGREGATE SUBBASES AND BASES

13.01 DESCRIPTION

This work shall consist of furnishing, spreading, and compacting aggregate subbases and bases as specified in Sections 25 and 26 of the State of California Standard Specifications and these Standard Specifications.

13.02 MATERIALS

Aggregate for subbases and bases shall be clean from vegetable matter and other deleterious substances, and shall be of such nature that it can be readily compacted under watering and rolling to form a firm, stable base.

13.03 GRADING

Aggregate subbase or base shall not be placed until the subgrade has been finished to a condition satisfactory to the Engineer and when placed, shall be accurately graded and compacted to proper profile and cross-section and at elevations which will result in the proper final grades when the specified thickness of paving has been applied and shall not vary from the planned grade by five hundredths of one foot (0.05') at any point for aggregate subbase and five hundredths of one foot (0.05') for aggregate base.

Placing of the aggregate subbase or base shall conform to the requirements of Sections 25-1.04 and 26-1.04 respectively of the State of California Standard Specifications except that use of a motor grader will be permitted.

13.04 COMPACTION

The relative compaction of each layer of compacted aggregate subbase material shall not be less than ninety percent (95%) and each layer of aggregate base shall be not less than ninety-five percent (95%) as determined by Test Method California No. 216. Compaction testing shall be provided as specified in Section 6.02 of these Standard Specifications.

13.05 AGGREGATE SUBBASE

Aggregate subbase shall conform to Section 25 of the State of California Standard Specifications. The class of aggregate subbase shall be as specified in the Special Provisions.

13.06 AGGREGATE BASE

Aggregate base shall be Class 2 and shall conform to the provisions in Section 26 of the State of California Standard Specifications. The gradation of the Class 2 aggregate base shall be as specified for three-quarters of one inch (¾") maximum aggregate.

13.07 SALVAGING EXISTING PAVEMENT

Where allowed, aggregate subbase or base may be composed of salvaged oiled earth and asphalt concrete (A.C.) from the existing roadway, supplemented with imported aggregate base material. The Engineer may require a thicker base section in order to compensate for a decreased "R" value of salvaged pavement. Unless otherwise specified, the Contractor shall pay for testing of "R" values for salvaged materials. When this system is used, the salvaged oiled earth material to be used by the Contractor shall be pulverized to a maximum diameter of two inches (2"). This pulverized, salvaged material shall be spread and compacted evenly over the entire subgrade area to the depth specified in the Special Provisions. The imported aggregate base is then to be spread and compacted evenly over the top of the compacted, pulverized, salvaged material to provide the required depth of base.

Where salvaging existing oil or A.C. for base is allowed, this salvaged material will not be allowed in the top two inches (2") of the base section; a minimum of two inches (2") of imported aggregate base will be required to insure a smooth, uniform surface on which to place pavement. Any surplus oil or pavement created because of this requirement shall be removed and disposed of by the Contractor as specified in Section 7-1.13 of the State of California Standard Specifications and no additional payment will be made therefore.

13.08 ADDITIONAL QUANTITIES

In the event that soil conditions are encountered such that a satisfactory subgrade, subbase or base for pavement may not be obtained, the material lying below the subgrade shall be removed and the additional subbase or untreated base material, as directed by the Engineer, shall be placed in accordance with the provisions of this section. All additional roadway excavation will be paid on a cubic yard basis. The additional volume of work shall be calculated by the "Average End Area" method.

Additional aggregate subbase or base shall be paid on the basis of bid item specified.

13.09 MEASUREMENT AND PAYMENT

a. Aggregate Subbase: Aggregate subbase shall be paid by the cubic yard. Quantities shall be calculated by the "Average End Area" method on the basis of the dimensions shown in the approved Construction Drawings, adjusted by the amount of any change ordered by the Engineer. Payment for aggregate subbase shall be made at the contract unit price per cubic yard for the class specified and shall include full compensation for furnishing all labor, materials (or processing selected materials), tools, equipment, and incidentals, and doing all work involved in hauling and constructing aggregate subbase, including pulverizing existing surfacing if required, completed, in place, as shown in the approved Construction Drawings, as specified in these Standard Specifications and the Special Provisions, and as directed by the Engineer.

b. Aggregate Base: Aggregate base shall be paid by the ton. Quantities shall be measured in accordance with the provisions of Section 9.02 of these Standard

Specifications.

Payment for the weight of material will be determined by deducting from the weight of material delivered to the work, the weight of water in the material at the time of delivery to the job, as determined by Test Method California No. 226, in excess of one percentage (1%) point more than the optimum moisture content as determined by Test Method California No. 216. Payment for the weight of water deducted as provided herein shall not be made. Tests ordered by the City Engineer shall be made at the expense of the City. Payment for aggregate base shall be made at the contract unit price per ton and shall include full compensation for furnishing all labor, materials, (including water in the material at the time the material is delivered to the job as previously provided), tools, equipment, and incidentals, and for doing all work involved in hauling and constructing aggregate base, (including pulverizing existing surfacing), complete, in place, as shown in the approved Construction Drawings, and as specified in these Standard Specifications and the Special Provisions, and as directed by the Engineer.

SECTION 14 - ASPHALT CONCRETE PAVEMENT

14.01 DESCRIPTION

Asphalt concrete pavement shall consist of furnishing and mixing aggregate and asphalt binder at a central mixing plant and spreading and compacting the mixture and applying prime coat, paint binder, and seal coat to or with the mixture, in accordance with Section 39 of the State of California Standard Specifications and these Standard Specifications.

14.02 AGGREGATE MATERIAL

All aggregates shall be clean and free from decomposed materials, organic materials, and other deleterious substances and conform to Section 39 of the State of California Standard Specifications. Gradation of the aggregate shall conform to the grading requirements for three-fourths of one inch (¾") maximum aggregate (medium) and one-half of one inch (½") maximum aggregate (medium).

14.03 ASPHALT CONCRETE

Asphalt concrete shall be Type B and shall conform to the provisions of Section 39 of the State of California Standard Specifications. The asphalt binder shall be steam refined paving asphalt classified as PG 64-10 in accordance with Section 92 of the State of California Standard Specifications.

14.04 SPREADING, LAYING AND COMPACTING

Spreading and laying operations shall conform to the requirements of Sections 39-5 and 39-6 of the State of California Standard Specifications. Where the total depth of paving exceeds two-tenths of one foot (0.20'), the top layer of asphalt concrete shall not exceed two-tenths of one foot (0.20') in compacted thickness. The aggregate for this layer and all lower layers shall be three-fourths of one inch (¾") maximum aggregate (medium). The next lower layer shall not exceed twenty-five hundredths of one foot (0.25') in compacted thickness. Any lower layers shall not exceed twenty-five hundredths of one foot (0.25') in compacted thickness.

No asphalt concrete paving shall be placed when the atmospheric temperature is below fifty degrees Fahrenheit (50º F) and at the discretion of the Engineer. Compaction operations shall conform to the requirements of Section 39-6.03 of the State of California Standard Specifications.

14.05 PRIME COAT

Prime coat shall be applied as specified in the Special Provisions.

14.06 SEAL COAT

Seal coat shall be applied as specified in the Special Provisions.

14.07 PAINT BINDER

Paint binder shall be furnished and applied in accordance with the provisions in Section 94, "Asphaltic Emulsions," of the State of California Standard Specifications, and shall be applied to all vertical surfaces of existing pavement, curbs, gutters, and construction joints in the surfacing against which additional material is to be placed, to a pavement to be surfaced, and to other surfaces designated by the Engineer.

The rate of application of the paint binder shall be five hundredths of one gallon per square yard (0.05gal/yd²) of surface covered. Full compensation for furnishing and applying the paint binder shall be included in the price bid for items requiring its application and no additional payment will be made therefore.

14.08 ASPHALT CONCRETE DIKES

Asphalt concrete dikes shall be constructed as shown in the approved Construction Drawings and in accordance with the Special Provisions. Only equipment specifically designed to install dikes shall be used for such installation. Payment for the specified asphalt concrete dike shall be as specified in the Special Provisions.

14.09 MEASUREMENT AND PAYMENT

Asphalt concrete pavement shall be measured by weight of the mixture complete, as specified in Section 9.02 of these Standard Specifications. Payment for the installation of asphalt concrete pavement shall be made at the contract unit price per ton and shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, including furnishing and applying asphalt paint binder, and for doing all work involved in constructing and placing asphalt concrete paving complete, as shown in the approved Construction Drawings, as specified in these Standard Specifications and the Special Provisions, and as directed by the Engineer.

SECTION 15 - RESTORATION OF SURFACES

15.01 DESCRIPTION

Restoration of surfaces shall consist of restoring the surfaces of all trenches, surfaces at or around structure sites, or any other surfaces damaged or disturbed by the work, to the condition existing prior to commencement of the work, or to such condition specified by any encroachment permit issued by the City for the work, or as specified in the Special Provisions. Surfaces shall include, but not be limited to, pavement of any kind, grass, shrubbery or other landscaping, gravel, treated or untreated soil. All work shall be done in accordance with these Standard Specifications.

15.02 PAVEMENT REPLACEMENT

Replacement of pavement shall conform to the minimum requirements specified herein, and to the requirements of Sections 13 and 14 of these Standard Specifications and the Engineering Improvement Standards, unless modified by the Special Provisions or encroachment permit issued by the City. Deviation from these requirements, unless approved by the Engineer shall be cause for rejection of the work.

If aggregate base material is removed, it may be allowed to be replaced with nine inches (9") minimum depth with new aggregate base in accordance with Section 13 of these Standard Specifications provided the same gravel equivalent thickness of base and paving as shown on the Standard Plan sections is maintained as determined by the Engineer.

Replacement of pavement shall be one inch (1") thicker than existing (3" minimum) and performed in a manner consistent with good construction practices and methods, shall be approved by the Engineer, and which, when completed, shall leave all areas requiring replacement of pavement with as neat an appearance as possible. When pavement replacement is within less than eight (8) years old pavement it shall be required to have seamless joints with the existing pavement by using a heater–remix process.

Pavement replacement shall be accomplished as soon as possible and practicable, and within the time limits specified in the Special Provisions.

Areas to receive pavement replacement shall be completely cleaned of all debris, rubbish, dirt, temporary paving, or any other deleterious material which might affect the quality of the work in any way. Cleaning shall be accomplished to a minimum of six feet (6') outside the edges of trenches or other areas to receive pavement replacement. This distance may be increased by the Engineer as necessary to prevent contamination of the new work.

Where saw-cutting of existing pavement edges is specified, the cut shall be made on a straight line along both sides of trenches, and to neat lines around structures or other locations requiring pavement replacement. The cut shall be made a minimum of three inches (3") in depth, or such other depth as may be specified in the Special Provisions, and shall encompass all pavement damaged by the work or specified to be removed or replaced.

All edges of existing pavement, whether trimmed or saw-cut, shall be protected from damage. Any edges damaged from any cause prior to or during paving operations, shall be re-cut or re-trimmed as directed by the Engineer, and no additional payment will be made therefore.

A paint binder of asphaltic emulsion shall be furnished and applied in conformance with Section 14.07 of these Standard Specifications to all vertical surfaces of existing pavement, curbs, gutters, or other surfaces against which asphalt concrete pavement is to be placed. Paint binder shall also be applied to the top surface of the initial layer of asphalt concrete if the pavement is to be replaced in lifts.

When replacing pavement in areas where saw cutting of existing pavement is specified, the new pavement material shall overlap the existing pavement edge as directed by the Engineer to a maximum of six inches (6") and "feathered" to match the existing paving. When compacted, the surface shall be smooth and without humps or depressions.

15.03 TEMPORARY PAVEMENT REPLACEMENT

Unless otherwise specified or unless otherwise required by an encroachment permit for the work, temporary replacement of existing pavement, where specified or directed to be placed by the Engineer, shall consist of a minimum thickness of two inches (2") of cut-back or "cold mix" asphalt concrete. The temporary pavement shall be diligently maintained by the Contractor until permanent pavement is installed.

15.04 MISCELLANEOUS SURFACE RESTORATION

Restoration of miscellaneous surfaces shall consist of replacing or restoring in-kind of any surface damaged or disturbed by the work, including, but not limited to, grass, landscaping of any kind, gravel, oiled dirt, concrete, or soil.

The surfaces of all trenches, excavations or other areas damaged or disturbed by the work, upon completion of miscellaneous surface restoration, shall conform to the elevations and character of the areas which existed before work commenced. Excess trench or excavation material shall not be spread over any part of the project site, unless authorized by the Engineer, and shall be disposed of in accordance with Section 7-1.13 of the State of California Standard Specifications.

15.05 MEASUREMENT AND PAYMENT

Pavement replacement will be paid for at the price bid per lineal foot or per square foot, as specified in the Special Provisions, and shall include full compensation for furnishing all labor, materials, tools and equipment, and doing all the work, including saw cutting or trimming of edges, involved in replacing pavement in place as specified in these Standard Specifications and the Special Provisions, and as directed by the Engineer.

Temporary pavement replacement and miscellaneous surface restoration shall be included in the various bid items of work, with no additional payment made therefore unless otherwise specified in the Special Provisions.

SECTION 16 - CONCRETE IMPROVEMENTS

16.01 DESCRIPTION

Concrete improvements shall consist of the construction of Portland cement concrete curb, gutters, sidewalks, driveway approaches, handicap ramps, valley gutters, and mowstrips in place and complete in accordance with these Standard Specifications, the Engineering Improvement Standards, and Sections 52 and 73 of the State of California Standard Specifications.

16.02 PORTLAND CEMENT CONCRETE

Portland cement concrete shall be Class 3 (five sack) concrete that meets the requirements of Section 10 of these Standard Specifications.

16.03 REINFORCEMENT

Reinforcement bar shall conform to the provisions of Section 52 of the State of California Standard Specifications.

16.04 SUBGRADE PREPARATION

The subgrade beneath concrete improvements shall be prepared true to grade and cross-section. It shall be compacted to a minimum of ninety-five percent (95%) relative compaction to a depth of six inches (6") beneath curbs and gutters, valley gutters, median and landscape curbs, and commercial driveway approaches. Sidewalks, ramps and single family residential drive approaches shall be compacted to a minimum of ninety-five percent (95%) relative compaction to a depth of six inches (6"). Relative compaction shall be determined by Test Method No. California 216.

All soft and spongy material shall be removed to a depth of not less than six inches (6") below subgrade elevation for all concrete improvements except sidewalks and three inches (3") below for sidewalks, and the resulting space filled with earth, sand or gravel then compacted to form a firm and solid foundation. The forms and subgrade shall be wet immediately prior to placing concrete.

Compaction testing shall be provided as specified in Section 6.02 of these Standard Specifications.

16.05 DRIVEWAY AND ALLEY APPROACHES, MOWSTRIPS, EXISTING CURBS, GUTTERS, VALLEY GUTTERS AND SIDEWALKS

Where the approved Construction Drawings provide for the reconstruction of a portion of an existing curb, gutter, valley gutter, sidewalk or mowstrips, the existing section shall be cut to a minimum depth of one and one half inches (1½") with an abrasive type saw at the line shown in the approved Construction Drawings or as determined by the Engineer, and the entire section to be reconstructed shall be removed. Saw cuts shall also be of sufficient depth to leave an even, straight line. The new curb, gutter, valley gutter, sidewalk or mowstrip shall

join the original at this line with a two inch by two inch (2" x 2") shovel footing under the existing concrete structure or doweled as directed by the City Engineer. Full compensation for the removal and disposal of existing concrete improvements shall be included in price bid for the various items of work requiring the removal or as specified in the Special Provisions.

16.06 STAMPED MEDIAN

a. Base prep: Two inch (2") minimum sand base over compacted subsoil. Sand base should be moist prior to concrete placement.

b. Concrete mix & placement: Concrete mix should be five (5) sack, two thousand five hundred pounds per square inch (2,500 psi) minimum with large aggregate mixes (¾ inch minimum) or six (6) sack if pea gravel mix used. Concrete should be placed at four inch (4") slump. Placement of concrete should be flush or slightly higher than adjacent curbs with a 2% crown to the center of the median. All curbs and street paving should be protected with two mill plastic to protect staining.

   Concrete should be colored by use of QC PRODUCT COLOR HARDNER-BRICK RED D.P. This color can be substituted with DAVIS PRODUCT-BRICK RED INTEGRAL COLORING at four pounds (4 lbs) per sack of cement with City of Visalia's Engineering approval.

   Broadcast color hardener shortly after bleed water dissipates from surface. Float color into surface by means of wood float. A second pass of color should be broadcast and floated shortly after first. A third pass of color maybe required if surface is not completely covered in red color.

   Liquid release solvent agent shall be applied evenly to the troweled surface just prior to imprinting. A powder release agent will not be accepted.

   BASKET WEAVE USED BRICK PATTERN shall be used to imprint plastic surface timed to leave a consistent pattern across surface.

   Cure and seal, or approved equal, shall be applied in accordance with the manufacture's recommendations immediately after completing the imprinting process.

   Jointing of fresh concrete should be every eight feet to ten feet (8'-10') by lightly scoring a grout line approx three-fourths of one inch (¾") deep soon after imprinting concrete by us of a CUT BAR. This can also be accomplished by us of an EARLY ENTRY CONCRETE SAW soon after concrete hardens enough to not leave tracking.

   Cut plastic along curb line and roll up residual powders and discard. All coloring agents and powders must be controlled to protect City's storm drain systems.

c. Utility boxes: All utilities boxes should be protect during concrete placement and flush with surface. Concrete edges should be edged and flush around boxes.

16.07 CONCRETE BLOCK WALL

a. Webs of each course shall center on webs below. Vertical cells shall have vertical alignment to maintain a clean unobstructed vertical flue measuring not less than three inches by three inches (3"x 3").

b. All bolts and anchors shall be set in grout one inch (1") minimum between bolts and masonry all around. See typical details for typical anchor bolt in masonry detail.

c. Footing dowels shall be provided at all points where cells are to be reinforced.

d. Reinforcing shall be straight and placed accurately in position. Vertical bars in cells shall be held in place by an approved mechanical device at top and bottom and at intervals not to exceed 192 bar diameters apart.

e. Where grouting is stopped for a period of one (1) hour or longer, horizontal construction joints shall be formed by stopping the grout pour one and one half inches (1½") below the top of the upper most unit.

f. Splices in reinforcing steel, unless otherwise specifically shown, shall be as follows:

   i. Horizontal bars at corners and ends ..... 40 diam. or 24" min.

   ii. Horizontal bars at all other locations ..... 64 diam.

   iii. Vertical bars at end of walls ..... 64 diam.

   iv. Intermediate vertical wall bars ..... 50 diam.

   v. Column bars ..... 50 diam.

g. Where the block is laid to a maximum of four feet (4') before grouting, no cleanouts shall be required. Where the block is laid to heights greater than four feet (4') before grouting, cleanouts shall be provided at the bottom of all cells. Cleanouts shall be a minimum of two inches by three inches (2" x 3").

h. The ends and corners of all walls shall have 1-#6 minimum vertical bar unless noted otherwise.

i. Cement grout shall consist of one (1) part portland cement, three (3) parts of sand, and no more than two (2) parts of three-eighths of one inch (⅜") pea gravel.

j. Cement mortar shall consist of one (1) part portland cement, two and one-fourth to three (2¼ - 3) parts of sand, and one-fourth to one-half (¼ - ½) part hydrated-lime or lime putty.

k. Grout shall have a minimum ultimate compressive strength of two thousand pound per square inch (2000 psi) at twenty-eight (28) days.

l. Ultimate compressive strength of prism units shall be a minimum of one thousand five hundred pounds per square inch (1500 psi) at twenty-eight (28) days.

m. Mortar shall have a minimum ultimate compressive strength of one thousand five hundred pounds per square inch (1500 psi) at twenty-eight (28) days.

n. At all wall piers less than five (5) times the wall thickness, horizontal steel reinforcing shall be changed to no. 3 ties at eight inches (8") on center hooked around jamb bars.

o. No vertical pipes or conduits greater than three-fourths of one inch (¾") in diameter shall be permitted in concrete masonry unit (cmu) wall. Conduit placement shall not dislocate any reinforcement. No reinforcing shall be cut to place pipes or conduit in wall without written approval of Engineer.

p. Concrete blocks shall conform to the requirements of ASTM C90-Grade N Type I Specification for hollow load bearing light weight concrete masonry units.

q. The Contractor shall obtain and provide the building official and the Engineer with a "Letter of Certification" that the concrete masonry units comply with compressive strength required in UBC Table 24-C prior to delivery of the units to the site or starting any masonry work.

r. The Contractor shall obtain and provide the building official and the Engineer with a "Letter of Certification" that the grout complies with a minimum two thousand pounds per square inch (2000 psi) compressive strength as required by UBC Table 24- C Footnote 4.

16.08 FORMS

Forms shall be of the quality and set in place as specified in Section 10.07 of these Standard Specifications and in Section 73-1.04 of the State of California Standard Specifications.

16.09 WEAKENED PLANE JOINTS

Weakened plane joints shall be placed and spaced at sixteen foot (16') centers or as shown in the Engineering Improvement Standards for the item of work. Weakened joints shall be a minimum of one inch (1") in depth in sidewalks and ramps and shall be finished with a one-fourth of one inch (¼") maximum radius edger. Weakened joints in curbs, gutters and drive approaches shall be a minimum of one and one half inches (1½") in depth and shall be finished with a one-fourth of one inch (¼") maximum radius edger.

16.10 IMPROVEMENTS; CONSTRUCTION OF CONCRETE IMPROVEMENTS

Curbs, gutters, sidewalks, driveway and alley approaches, valley gutters and mowstrips shall conform to Section 73 of the State of California Standard Specifications, the Engineering Improvement Standards, and these Standard Specifications.

Extruded curb and gutter shall be constructed with Class 3 concrete.

All concrete work shall be finished with a steel trowel and given a brush finish.

16.11 CURING

The concrete shall be cured in accordance with Section 10.08 of these Standard Specifications. When maximum daytime temperature exceeds fifty degrees Fahrenheit (50º F) all newly placed concrete shall be sprayed uniformly with a curing compound. Curing compound shall be applied at a nominal rate of one gallon per one hundred fifty square feet (1 gal/150 ft²), unless otherwise specified.

16.12 ROCK POCKETS

Immediately upon stripping curb forms and prior to backfill, all rock pockets or honeycombs shall be repaired to the satisfaction of the Engineer.

16.13 BACKFILLING

After removal of forms, the area behind the sidewalk shall be cleaned of all surplus concrete and other debris and the area filled with clean earth suitable for planting. If the excavation for gutter has been made in a bituminous surfaced street, the space occupied for forms shall be backfilled with freshly prepared bituminous surfacing material thoroughly tamped into place and leveled off to meet the existing street surface.

16.14 MEASUREMENT

The length of concrete curbs, gutters and mowstrips to be paid for shall be the length in feet designated by the Engineer. The area of concrete sidewalk, driveway and alley approach, and valley gutter to be paid for shall be the area in square feet designated by the Engineer.

16.15 PAYMENT

The price paid per linear foot of concrete curb, gutter, valley gutters in alleys, or mowstrips and the price paid per square foot of concrete sidewalk, driveway, alley approach, and valley gutter shall include full compensation for furnishing all labor, material, tools and equipment and doing all the work involved in constructing concrete curbs, gutters, mowstrips, valley gutters and sidewalks, including curing, all as shown in the approved Construction Drawings, as specified in these Standard Specifications and in the Special Provisions, and as directed by the Engineer.

SECTION 17 - SEWER AND STORM DRAIN PIPE

17.01 DESCRIPTION

This work shall consist of furnishing and installing sewer and storm drain pipe as shown in the approved Construction Drawings, as directed by the Engineer, and as specified in these Standard Specifications.

All precast pipe shall be of the size and class shown in the approved Construction Drawings or specified in the Special Provisions. The pipe class, as designated in the approved Construction Drawings, has been determined for vertical load under average trench conditions. The Contractor shall exercise precautionary measures against trench cave-ins by providing adequate shoring or other devices to minimize the development of adverse trench conditions. Should the trench condition exceed in width the average trench condition, the Contractor shall provide a recognized special bedding, approved by the Engineer, which is adequate to maintain pipe strength equivalent to the average trench condition. No additional compensation will be paid for such special bedding. In lieu of special bedding and the class of pipe designated in the approved Construction Drawings, the Contractor may provide a class of pipe in accordance with the manufacturer's recommendation for the conditions under which the pipe is placed, with no additional payment therefore.

17.02 TYPES OF PIPE

a. Storm Drain Pipe: Where "storm drain pipe" is specified in the approved Construction Drawings, the Contractor will be allowed to install either reinforced concrete pipe, non-reinforced concrete pipe, or polyvinyl chloride pipe (PVC) conforming to these Standard Specifications except where a particular type of pipe is specified in the approved Construction Drawings or in the Special Provisions. Where a particular type of pipe is specified in the approved Construction Drawings or in the Special Provisions, only that type of pipe shall be installed and no substitution will be allowed except as specified in Section 17.05 of these Standard Specifications. Once pipe laying operations have begun, the Contractor will not be allowed to switch to a type of pipe different from that laid without prior approval from the Engineer.

   Rubber gasketed concrete pipe conforming to these Standard Specifications shall be installed if "rubber gasketed storm drain pipe" is specified in the approved Construction Drawings. Where a particular type of pipe is specified in the approved Construction Drawings or in the Special Provisions, only that type of pipe shall be installed and no substitution will be allowed except as specified in Section 17.05 of these Standard Specifications.

   The strength of pipe to be installed shall be specified in the approved Construction Drawings as either Class II (Cl II), Class III (Cl III), Class IV (Cl IV) or Class V (Cl V). These strength classifications are based on the D-Load to produce the ultimate load in the 3-edge bearing strength test, ASTM Designation: Test Method C497 or C500. The following table shall be used to determine the strength class of pipe to be installed by the Contractor to meet the class specified in the approved Construction Drawings:

Pipe Class on Drawings	CL II	CL III	CL IV	CL V
Reinforced Concrete Pipe	CL II	CL III	CL IV	CL V
(C76)	1500D	2000D	3000D	3750D
Nonreinforced Concrete Pipe	E.S.	E.S.	N/A	N/A
(C14)	1500D	2000D	3	000D

*E.S. = Extra Strength
*N/A = Not Available

The Contractor's attention is called to Section 17.01 of these Standard Specifications in regards to strength requirements specified in the approved Construction Drawings.

b. Sewer Pipe: Where "sewer pipe" is specified in the approved Construction Drawings, the Contractor will be allowed to install either vitrified clay pipe, or poly vinyl chloride (PVC) pipe conforming to these Standard Specifications except that once pipe laying operations have begun, the Contractor will not be allowed to switch to a type of pipe different from that being laid without prior permission from the Engineer. The final determination as to the suitability of any pipe for use as sewer pipe shall be made by the City Engineer.

Sewer pipe shall be designed such that the slope of the proposed line will create a velocity of two feet per second (2 ft/sec) when the pipe is flowing half full using a Manning's "N" of eleven thousandths (0.011).

Minimum Acceptable Slopes For Sewer Pipe

Pipe Diameter (inches)	Slope at 2 F.P.S. Velocity (percent) (for vitrified clay pipe)
6	0.35
8	0.24
10	0.18
12	0.14

Once pipe laying operations have begun, the Contractor will not be allowed to switch to a type of pipe different from that being laid without prior permission from the Engineer. The final determination as to the suitability of any pipe for use as sewer pipe shall be made by the City Engineer. Where a particular type of pipe is specified in the approved Construction Drawings or in the Special Provisions, only that type of pipe shall be installed and no substitution will be allowed without permission from the City Engineer.

17.03 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

All HDPE for sanitary sewers shall be Class 63. Pipe material shall meet the requirements of Type III. Class C, Category 5, Grade P34 as defined in ASTM D1248 Standard Specification for polyethylene plastics molding and extrusion materials.

Gaskets shall meet the requirements of ASTM F477 and be molded into a circular form or extruded to the proper section and then spliced into circular form and shall be made of a properly curbed high grade elastomer compound. The basic polymer shall be natural rubber, synthetic elastomer or a blend of both. The lubricant used for assembly of gasket joints shall have no detrimental effect on the gasket or on the pipe.

The Contractor shall have the manufacturer furnish a "Certificate of Conformance" to these Standard Specifications.

Upon completion of backfill and compacting trenches, the Contractor, at his expense, shall pull a properly sized mandrel through the installed main line to demonstrate the maximum pipe deflection does not exceed five percent (5%). If excessive pipe deflection obstructs passage of the mandrel, the Contractor shall excavate and make suitable repairs to the Engineer's satisfaction.

17.04 POLYVINYL CHLORIDE (PVC) LARGE DIAMETER RIBBED PIPE

Large diameter ribbed pipe and fittings materials shall meet and/or exceed all of the requirements of ASTM F794 Specification.

Minimum pipe stiffness (F/y) at five percent (5%) deflection shall be forty-six (46) for all sizes when tested in accordance with ASTM method D2412.

Special care shall be taken in the installation of PVC pipe so that no more than five percent (5%) deflection occurs in the pipe. The bottom of trench shall be formed such that the pipe can be placed with uniform support along its length.

The first lift of backfill shall be placed by hand and shall extend only to the pipe springline and hand tamped; the second lift of backfill shall extend to six inches (6") above the top of the pipe and hand tamped only on the sides of the pipe.

Documentary evidence of test results will be considered sufficient when pipe manufacturer furnishes a certificate indicating that the pipe has been subjected to and passed hydrostatic, load, and chemical resistance tests conducted in accordance with approved methods.

Upon completion of backfill and compacting trenches, the Contractor, at his expense, shall pull a properly sized mandrel through the installed main line to demonstrate the maximum pipe deflection does not exceed five percent (5%). If excessive pipe deflection obstructs passage of the mandrel, the Contractor shall excavate and make suitable repairs to the Engineer's satisfaction.

17.05 POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS

a. Materials: Poly vinyl chloride (PVC) pipe and fittings shall be manufactured in accordance with ASTM Designation: D3034 – 73.

   The minimum allowable pipe stiffness (F/AY) for all sizes shall be forty-six pounds per square inch (46 psi) at five percent (5%) deflection when tested in

accordance with ASTM Test Method D2412. Pipe and fittings shall be manufactured and supplied with bell and spigot joints which are an integral part of the pipe or fitting.

Upon demand, the manufacturer of PVC pipe shall furnish to the Engineer a "Certificate of Compliance" in accordance with the provisions of Section 6.03 of these Standard Specifications. External loading properties of plastic pipe by parallel-plate loading, and shall conform to the following dimensions and tolerances, as in accordance with ASTM designation D3034-73:

Inside Diameter Inches	Minimum Wall Thickness Inches	Average O.D.
4	0.125	4.215
6	0.180	6.275
8	0.240	8.400
10	0.300	10.500
12	0.360	12.500
15	0.437	15.300

For pipe larger than fifteen inches (15") in diameter, the Contractor shall submit to the City Engineer the specification for the pipe for approval.

Special care shall be taken in the installation of PVC Pipe so that no more than five percent (5%) deflection occurs in the pipe. The bottom of trench shall be formed such that the pipe can be placed with uniform support along its length.

Documentary evidence of test results will be considered sufficient when pipe manufacturer furnishes a certificate indicating that the pipe has been subjected to and passed hydrostatic, load, and chemical resistance tests conducted in accordance with approved methods.

Upon completion of backfill and compacting trenches, Contractor, at his expense, shall pull a properly sized mandrel through the installed main line to demonstrate the maximum pipe deflection does not exceed five percent (5%). If excessive pipe deflection obstructs passage of the mandrel, the Contractor shall excavate and make suitable repairs to the Engineer's satisfaction

b. Joints: Joints for PVC pipe and fittings shall be elastomeric gasket type able to withstand contraction and expansion and be able to prevent displacement during assembly after the pipe has been locked into place. Joints shall be water tight when tested in accordance with ASTM Test Method D2855.

Joints shall be of such a design that when the pipe is properly laid, there shall be a smooth and uniform interior surface. Ends of pipe sections and fittings shall be free of cracks and broken edges. Pipe found to be so damaged shall be rejected for use in the work.

The ends of the pipe shall be thoroughly cleaned immediately prior to joining sections of pipe. Pipe shall then be joined together as recommended by the manufacturer. Gaskets shall be properly lubricated and the pipe "homed" as far as

recommended. No appreciably gap shall exist at the completed joint, except as permitted by the Engineer. Excess gaps in any case shall be cause for rejection of the work, and corrective measures shall be taken when ordered by the Engineer.

c. Pipe Laying: Pipes shall be laid in conformity with the prescribed lines and grades obtained from stakes set by the Engineer. The pipe shall be laid uphill from structure to structure with the bell (or groove) end up-grade. Occasional variations in grade will be permitted as follows: Above grade, one-fourth of one inch (¼"), below grade, not to exceed one-half of one inch (½"); alignment, not to exceed three inches (3") or uniform deflection in a distance of twenty feet (20'). Adjustments of pipes to line and grade shall be made under the body of the pipe throughout its entire length and not by blocking or wedging. Bell holes shall be accurately placed and shall not be larger than is reasonably required to make the joint. Before the pipe is laid, the interior of the bell of the preceding pipe shall be carefully cleaned. After each section of pipe has been laid to line and grade, it shall be joined to the preceding section as required in Section 17.06.b, "Joints" of these Standard Specifications. After jointing procedure has commenced, there shall be no movement of the pipe whatsoever in subsequent operations. Material shall be placed uniformly on either side of the pipe to prevent any movement, in accordance with Section 12.06 of these Standard Specifications. No walking in the trench or working over the pipe after it has been laid, except as may be necessary in tamping the earth and refilling, will be permitted until the pipe has been braced as specified above. The open ends of all sewer lines being installed shall be covered to keep out animal life, etc., whenever the line is left unattended for any length of time, such as overnight.

d. Bedding: Bedding for PVC pipe shall conform to the requirements of ASTM Designation: D2321, for the type and class of material encountered in the trench. These Standard Specifications shall take precedence over other bedding requirements specified in those Specifications, but not exclude them.

e. Backfill: The first lift of backfill shall be placed by hand and shall extend only to the pipe springline and hand tamped; the second lift of backfill shall extend to six inches (6") above the top of the pipe and hand tamped only on the sides of the pipe. This backfill shall be performed as specified in Section 12.06 of these Standard Specifications except that the initial backfill operation shall conform to the requirements of the "Haunching and Initial Backfill" section of ASTM Designation: D2321.

f. Deflection Test: Deflection testing shall be provided by the Contractor for all PVC installations. The Contractor shall demonstrate that the maximum pipe deflection does not exceed five percent (5%) of the diameter of the pipe installed by pulling a properly sized solid ball or mandrel or a rigid set of discs, as approved by the Engineer, through the pipe.

Where deflection of the pipe exceeds the allowable, the Contractor shall, at his own expense, make suitable repairs to the line before it is offered for retesting and acceptance. All repairs shall be made to the satisfaction of the Engineer. Deflection testing shall be paid for at the unit price bid per linear foot of pipe when the items

of work are included in the bid proposal. When no item of work is included in the bid proposal, payment for the testing shall be considered to be included in the price bid for the various items of work requiring the testing and no additional payment will be made therefore. Full compensation for providing deflection testing, including furnishing all labor, materials, tools, equipment, and incidentals, and doing all work involved in performing the required testing shall be included in the unit price bid per linear foot for deflection testing or included in the various items of work requiring the testing and no additional payment will be made therefore.

17.06 REINFORCED CONCRETE PIPE

a. Materials: Reinforced concrete pipe shall be manufactured in accordance with ASTM Designation: C76, as amended or revised. When used as a sanitary sewer application this pipe shall be PVC lined.

Upon demand, the manufacturer of pre-cast concrete pipe shall furnish to the Engineer a "Certificate of Compliance" in accordance with the provisions in Section 6.03 of these Standard Specifications.

The cement used in manufacture shall be Type II, as per ASTM C150. Unless otherwise noted in the approved Construction Drawings, provide Class III pipe fpr all pipe buried ten feet (10') or less, Class IV for pipe buried eleven feet to fifteen feet (11'-15'), and Class V pipe buried greater than sixteen feet (16'). All pipe approved will have an interior surface which is free from roughness, projections, indentations, offsets or irregularities of any kind. Pipe type could vary dependent upon "D" loads. Engineer to specify and provide verification.

b. Pipe Lengths: Furnish pipe in standard lengths. Shorter lengths may be used where required by construction details or when approved by the City.

c. Repairs: Pipe may be repaired, if necessary, because of occasional minor imperfections in manufacture or accidental injury during handling and will be acceptable if, in the opinion of the City, the repairs are sound, properly finished and cured, and the repaired pipe conforms to the requirements of ASTM C76. Use mortar for repairs which has a compressive strength of six thousand (6,000) psi at the end of twenty-eight (28) days.

d. Marking: Mark all pipe in accordance with ASTM C76; no pipe will be accepted unless these markings appear on all pipe.

e. Joints: The ends of reinforced concrete pipe sections shall be of such design that when properly laid they shall have a smooth and uniform interior surface. Both ends of pipe sections shall be substantially free of cracks and broken edges. Pipe so found to be damaged shall be rejected for use in the work. Each joint shall be sealed to prevent leakage. Sealing of joints shall be accomplished with rubber gaskets, as indicated in the approved Construction Drawings or specified in the Special Provisions, and shall conform to the following specifications:

i. Rubber Gasketed Joints: Rubber gasketed joints shall conform to the

requirements of ASTM Designation: C443 and shall be flexible and able to withstand expansion, contraction and settlement.

The ends of the pipe shall be thoroughly cleaned immediately prior to joining sections of pipe. The two (2) sections joined shall be firmly placed together in such a manner that the tongue or gasket end of the pipe "homes" on the bell end of the pipe. No appreciable gap shall exist at the completed joint, except as permitted by the Engineer at locations where curves in the pipe alignment are specified or required. Excessive gaps in any case shall be cause for rejection of the work, and corrective measures shall be taken when ordered by the Engineer.

ii. Construction Joints: Whenever two (2) sections of pipe are to be joined where standard joints are not available, such as joining reinforced concrete pipe to cast-in-place or asbestos cement pipe, a concrete collar shall be constructed around the full periphery of the pipe and extending one foot (1') each side of the joint. The collar shall be of a minimum thickness equal to that of the concrete pipe, but in no case less than four inches (4") thick. The interior of the joint shall be smoothed with cement mortar and brushed. The area to receive the collar shall be thoroughly cleaned and dampened immediately prior to construction of the collar. The cost of constructing concrete collars shall be considered as included in the cost of the items requiring the collar, and no additional payment will be made therefore.

f. Pipe Laying: Pipes shall be laid in conformity with the prescribed lines and grades obtained from stakes set by the Engineer. The pipe shall be laid uphill from structure-to-structure with the bell (or groove) end up-grade. Pipe with elliptical reinforcement shall be placed with the minor axis in a vertical position. Adjustments of pipes to line and grade shall be made under the body of the pipe throughout its entire length and not by blocking or wedging. Bell holes shall be accurately placed and shall not be larger than is reasonably required to make the joint. Before the pipe is laid, the interior of the bell of the preceding pipe shall be carefully cleaned. After each section of pipe has been laid to line and grade, it shall be joined to the preceding section as required in Section 17.07.e, "Joints" of these Standard Specifications. After jointing procedure has commenced, there shall be no movement of the pipe whatsoever in subsequent operations. Material shall be placed uniformly on either side of the pipe to prevent any movement, in accordance with Section 12.06 of these Standard Specifications. For mortar joint pipe, no walking in the trench or working over the pipe after it has been laid, except as may be necessary in tamping the earth and refilling, will be permitted until the pipe has been braced as specified above.

17.07 CAST-IN-PLACE CONCRETE PIPE

a. Materials: Concrete used in the construction of non-reinforced cast-in-place concrete pipe and cement mortar used for patching, smoothing or repair of cast-in-place concrete pipe shall conform to the requirements of Section 10 "Portland Cement Concrete, Cement Mortar" of these Standard Specifications.

Concrete shall be either Class "A" (six sack mix), or Class "B" (five sack mix), and shall develop a minimum compressive strength of two thousand eight hundred pounds per square inch (2,800 psi) at twenty-eight (28) days.

Admixtures shall be used only in conformity with the requirements of Section 10.04 of these Standard Specifications.

Coarse and fine aggregate gradation shall conform to the requirements of Section 10.02 "Materials" of these Standard Specifications and these coarse aggregate maximum size limitations:

Pipe Diameter	Maximum Aggregate Size
24" to 48"	1" maximum
48" and over	1 ½" maximum

Coarse and fine aggregate shall also conform to ASTM Designation: C-33-57 as revised.

Reinforced concrete pipe may be substituted for cast-in-place concrete pipe at any location and shall comply with the following provisions:

i. Reinforced concrete pipe shall conform to the requirements of Section 17.04 of these Standard Specifications.

ii. Substituted pipe shall have the same internal diameter as specified for cast-in-place pipe. The pipe class shall be as specified or as determined by the Engineer.

iii. Joints on substituted pipe shall be of the cement mortar type unless otherwise indicated in the approved Construction Drawings or in the Special Provisions.

iv. Payment shall be at the unit price bid for cast-in-place concrete pipe with no additional compensation paid therefore, except as provided in this Section.

b. Nominal Internal Diameter: The nominal internal diameter shall be the size indicated in the approved Construction Drawings. The actual internal diameter of the pipe at any point shall not be more than five percent (5%) less than the nominal internal diameter, and the actual internal cross-sectional area of the pipe at any point shall not be less than the cross-sectional area of a circle computed from the nominal internal diameter. The Contractor may be allowed to construct pipe of larger sizes than that specified in the approved Construction Drawings; however, any and all deviations in sizes from that specified must be approved by the Engineer.

c. Wall Thickness: Minimum wall thickness for the various sizes of pipe shall conform to the following table:

Internal Diameter	Minimum Wall Thickness of Pipe
24”	3”
30”	3”
33”- 36”	3½”
42”	4”
48”	5”
54”	5½”
60”	6”
66”	6½”
72”	7”
78”	7½”
84”	8”
90”	8½”
96”	9”

d. Excavation: Excavation shall conform to the requirements of Section 12.05, “Trench and Structure Excavation” of these Standard Specifications.

e. Bedding: Bedding shall conform to the requirements of Sections 12.05 and 17.13 of these Standard Specifications, unless otherwise specified in the Special Provisions.

f. Pipe Construction (Feasibility): The City makes no guarantee as to the types of soil or of soil conditions within the project limits. The Contractor shall perform whatever soils or other tests as he deems necessary to make himself fully aware, prior to submitting a bid proposal, of the soil types or conditions which may prevail throughout the project site. Tests so performed shall be conducted at the Contractor’s expense, and no compensation will be paid therefore.

   Where unstable trench conditions are encountered, the Contractor shall attempt to stabilized the trench by shoring or, wherever practical, by sloping the sides of the trench above the top of the pipe.

   Where the Engineer determines, due to unstable trench conditions or other reasons, that it is not feasible to place cast-in-place concrete pipe, the Contractor shall place reinforced concrete pipe of the same size and class indicated in the approved Construction Drawings or Bidder’s proposal, or a specified in the Special Provisions. The Contractor will be paid for reinforced concrete pipe so placed at the unit price bid for cast-in-place pipe and no additional compensation paid therefore.

   Construction of cast-in-place concrete pipe may be considered as not feasible when the trench walls are not stable below a distance above the bottom of the trench equal to one-half the diameter of the pipe. The Engineer, however, shall be the sole judge as to the feasibility of constructing cast-in-place concrete pipe as shown in the approved Construction Drawings. Construction of cast-in-place concrete pipe shall be considered as feasible where fifty feet (50’) or more of stable trench is encountered.

g. Pipe Construction: Pipes shall be constructed in conformity with the prescribed lines and grades obtained from stakes set by the Engineer.

All surfaces against which concrete is to be placed shall be free from standing water, mud and debris and shall be firm enough to prevent contamination of the concrete by earth or other foreign material.

Absorptive surfaces against which concrete is to be placed shall be moistened thoroughly so that the moisture will not be drawn from the freshly placed concrete.

When placing operations cease or are delayed for any reason for more than thirty (30) minutes, the end of the pipe shall be left rough with a slope of approximately thirty degrees (30º) and the ends of the pipe shall be securely closed by heavy canvas or other acceptable material to prevent excessive dehydration of the concrete already placed. The joint so formed when placing operations again commence shall conform to the requirements of Section 17.05b of these Standard Specifications.

Cast-in-place pipe shall be constructed in one placement around the complete periphery of the pipe by means of a traveling pipe-casting-machine approved by the Engineer. The Bidder may be required to furnish evidence of successful in-service performance of pipe produced by the pipe-casting-machine under similar working conditions.

Pipe shall be cast-in-place in a manner such that as forms are lapped, the lap ridges formed in the interior walls of the pipe face downstream in the direction of flow.

Forms used in the work shall be clean and reasonably free of concrete adhering to the surface of the forms from previous operations. Immediately prior to use in the work, work, each form shall be sprayed or otherwise coated with an approved form oil. Forms used shall be of sufficient strength to withstand vibrating of concrete and which will provide interior dimensions of the pipe in accordance with the tolerances of Section 17.05 of these Standard Specifications. Damaged forms shall not be used in the work and shall be removed from the job site.

h. Construction Joints: Where construction of cast-in-place concrete pipe stops short of a manhole or other structure and construction will continue at a later time, or where cast-in-place pipe is to be jointed to pre-cast pipe, the resulting joint shall be reinforced by constructing a concrete collar around the joint. This collar shall extend one foot (1') each side of the joint around the full periphery of the pipe, and shall be equal in thickness to the wall thickness of the joined pipe, but in no case less than four inches (4"). The area to receive the collar shall be thoroughly cleaned and dampened immediately prior to constructing the collar. The cost of constructing concrete collars shall be considered as included in the cost of the various items requiring construction of concrete collars, and no additional payment will be made therefore.

i. Curing: Immediately after finishing of the exposed exterior surface of the pipe, it shall be covered with an approved polyethylene or plastic membrane which shall be anchored sufficiently to keep the surface covered.

Unless the pipe terminates at a structure which is closed to the air, the ends of the pipe, as well as any other openings, shall be securely closed with an impermeable membrane for a minimum of seven (7) days or until the structure is constructed, if sooner. Precaution shall be used to make the structure reasonably air-tight for a minimum of seven (7) days, except when work is taking place inside the pipe.

j. Finish: The exterior exposed surface of the pipe shall have a steel screeded finish. A hand trowel shall be used, as construction progresses, to smooth areas not sufficiently smoothed by the pipe-casting machine. All finishing of the exterior shall be accomplished immediately as pipe construction progresses.

The interior surface of the pipe shall be equivalent to a steel screeded finish. All honey-combed or minor voids shall be chipped out, filled and smoothed with cement mortar. Major voids shall be repaired with Portland Cement Concrete (Class 2 or 3) in a manner prescribed by the Engineer.

Excessive longitudinal ridges along the sides of the interior of the pipe shall be chipped back and smoothed with cement mortar as directed by the Engineer. Form lap offsets exceeding the limits established below shall be chipped back and smoother with mortar.

Pipe Diameter	Maximum Offset
24” - 30”	3/8”
33” - 42”	1/2”
48” - 66”	5/8”
72” - 90”	7/8”
96” – larger	1”

Interior finishing shall be accomplished as soon as possible or practical after placing of the pipe and shall be subject to the provisions of Section 17.17, “Payment” of these Standard Specifications.

k. Concrete Tests: During the placing operations, the Contractor, if requested, shall assist the Engineer in securing three (3) standard test cylinders for each fifty (50) cubic yards, or portions thereof, per day. Test cylinders shall be tested for strength by a recognized testing laboratory. The cost of such tests will be at the Contractor’s expense and certified copies of the results will be submitted to both the Contractor and the Engineer. One (1) of the cylinders will be tested at the end of seven (7) days; one (1) of the test cylinders will be tested at the end of twenty-eight (28) days; and one (1) of the test cylinders will be held to be tested at the discretion of the Engineer, all in accordance with the procedures established by the ASTM Designation: C39.

l. Hydrostatic Tests: When hydrostatic testing is specified and when the concrete has reached a compressive strength of two thousand eight hundred pounds per square inch (2,800 psi), the Contractor shall test the pipe with water to the maximum operating head. The line may be tested in one length or in sections, as approved by the Engineer. Each test shall be maintained for twenty-four (24) hours at the maximum operating head.

All leaks creating wet spots at the soil surface, or otherwise exposed by the test, shall be repaired by and at the expense of the Contractor. Leakage loss during this test period shall not exceed one thousand gallons (1,000 gal) per inside diameter inch per mile of pipe installed, for a period of twenty-four (24) hours.

Where leakage exceeds the allowable, the Contractor shall discover the cause and remedy it before the line is offered for retesting and acceptance. If the leakage is less than the allowable, and individual leaks are observed, such leaks shall be repaired in a manner satisfactory to the Engineer.

17.08 VITRIFIED CLAY PIPE AND FITTINGS

a. Materials: Vitrified clay pipe and fittings shall be extra strength bell and spigot pipe manufactured in accordance with ASTM Designation: C200.

Upon demand, the manufacturer of vitrified clay pipe shall furnish to the Engineer a "Certificate of Compliance" in accordance with Section 6.03 of these Standard Specifications.

b. Joints: Joints shall be performed factory fabricated plastisol joints manufactured in accordance with ASTM Designation: C425.

Joints shall be of such a design that when the pipe is properly laid there shall be a smooth and uniform interior surface. Ends of pipe sections and fittings shall be free of cracks and broken edges. Pipe so found shall be rejected for use in the work.

The ends of the pipe shall be thoroughly cleaned immediately prior to joining sections of pipe. The two (2) sections joined shall be firmly placed together in such a manner that the spigot end of the pipe "homes" on the bell end of the pipe. No appreciable gap shall exist at the completed joint, except as permitted by the Engineer at locations where curves in the pipe alignment are specified or required. Excessive gaps in any case shall be cause for rejection of the work, and corrective measures shall be taken when ordered by the Engineer.

c. Pipe Laying: Pipes shall be laid in conformity with the prescribed lines and grades obtained from stakes set by the Engineer. The pipe shall be laid uphill from structure to structure. Occasional variations in grade will be permitted as follows: Above grade one-quarter inch (¼"); below grade not to exceed one-half inch (½"); alignment not to exceed three inches (3") if gradual over a distance of twenty feet (20'). Adjustments of pipes to line and grade shall be made under the body of the pipe throughout its entire length and not be blocking or wedging. Bell holes shall be accurately placed and shall not be larger than is reasonably required to make the joint. Before the pipe is laid, the interior of the bell of the preceding pipe shall be carefully cleaned. After each section of pipe has been laid to line and grade, it shall be joined to the preceding section as required in Section 17.09.b, "Joints" of these Standard Specifications. After jointing procedure has commenced, there shall be no movement of the pipe whatsoever in subsequent operations. Material shall be placed uniformly on either side of the pipe to prevent any movement, in accordance with Section 12.06 of these Standard Specifications. No walking in the

trench or working over the pipe after it has been laid, except as may be necessary to tamping the earth and refilling, will be permitted until the pipe has been braced as specified above. The open ends of all sewer lines being installed shall be covered to keep out animal life, etc., whenever the line is left unattended for any length of time, such as overnight.

17.09 WYES (GENERAL)

Wyes shall be of the same material as the main sewer line and be manufactured to be compatible with the pipe with which they are installed. They shall conform to the strength and jointing requirements of the Standard Specifications that covers the type of pipe with which they are to be installed.

The Contractor shall place wyes of the size specified at the locations shown in the approved Construction Drawings or as directed by the Engineer. Wyes, unless otherwise specified, shall be inclined at an angle from the horizontal of not greater than forty-five degrees (45°).

Each wye that does not terminate in a manhole shall be closed at the bell with a cap made for that purpose.

a. Payment: Payment for wyes shall be made on a unit price per each basis, or as otherwise specified in the Special Provisions, and shall include full compensation for supplying all labor, materials, tools, caps, equipment, and incidentals, and doing all work involved in furnishing and installing the wye as shown in the approved Construction Drawings and as specified in these Standard Specifications and the Special Provisions, and as directed by the Engineer, and no additional payment will be made therefore.

17.10 HOUSE BRANCHES (GENERAL)

Sewer house branches shall be installed at the locations shown in the approved Construction Drawings and in conformance with the Engineering Improvement Standards.

Four inch (4") and six inch (6") diameter branches may be connected directly to sewer mains eighteen inch (18") or greater in diameter providing that the type of connection to the main is approved by the Engineer.

House branches eight inch (8") or greater in diameter must connect to mains with a manhole structure. Installation of house branches shall commence at the bell of the wye or from the manhole and extend to a point five feet (5') inside the property line. At this point, the branch shall be plugged to seal the ends with a plug that is approved by the manufacturer of the pipe for use with his product.

a. Marking: The location where the sewer crosses beneath curb and gutter shall be marked on the curb with the letter "S". In cases where a concrete curb does not exist or will not exist in the near future, the Contractor shall mark the end of the house branch with a two inch by four inch (2" x 4") board, three feet (3') long that extends one foot (1') above the ground.

House branches shall be installed in existing streets in such a manner that the street will be open to traffic at all times.

17.11 PIPE LINE ACCEPTANCE TEST (SANITARY AND STORM)

The sewer line acceptance test shall be a low pressure air test performed under the supervision of the Engineer and utilizing the following procedure:

Test shall not be made until the section of pipe to be tested, including house branches, has been cleaned, completely backfilled and the trenches compacted as specified in Section 12.06 of these Standard Specifications.

a. Mandrel: Deflection test shall be performed as stated in Sections 17.04, 17.05 and 17.06 of these Standard Specifications.

b. Air Test: The air test is to be made on the pipe installation without the addition of seals to the pipe interior. The application of mortar, epoxy, caulking compounds, or other material to the pipe will be prohibited unless authorized by the City Engineer. Failure to meet the air test will require the Contractor to replace sections as required. Any broken pipe, separation of joints, or any pipe not laid true to line and grade, shall be replaced. All test expenses are to be borne by the Contractor.

   Plugs to be used in the test shall be the pneumatic type equipped with pressure gauges for measuring air pressure in the sewer pipe to be tested. The pressure gauges shall be calibrated in one-half of one pound per square inch (½ psi) increments and connected to the plug in such a way that when the plug is placed in the installed line, the gauge can be located outside of the manhole.

   All plugs shall be seal tested before being used in the actual test installation. The seal test shall be conducted by placing in both ends of a pipe laying on the ground, the plugs to be tested. The plugs shall then be inflated to twenty-five pounds per square inch gauge (25 psig). The sealed pipe shall then be pressurized to five pounds per square inch gauge (5 psig). The plugs shall not move when subjected to this pressure.

   Length of line tested at one time shall be limited to the length between adjacent manholes.

   Air test procedure shall be as follows: Pressure the test section to three and one-half pounds per square inch (3½ psi) and hold above three pounds per square inch (3 psi) for not less than five (5) minutes. Add air if necessary to keep pressure above three pounds per square inch (3 psi). At the end of this five (5) minute saturation period, note the pressure (must be 3.0 psi min.) and begin the timed period. If the pressure drops one-half of one pound per square inch (½ psi) in less than the time given in the following table, then the section of pipe shall not have passed the test.

Line Size	Minimum Time (Seconds)
4”	122
6”	184
8”	245
10”	306
12”	367
15”	460

For larger diameter pipe use the following formula:

Minimum Time (seconds) = 370 multiplied by pipe diameter (feet)

If the test is not passed, the leak shall be found and repaired to the satisfaction of the Engineer and the length of the repaired line retested.

The pressure gauge used shall be supplied by the Contractor, shall have minimum divisions of one tenth of one pound per square inch (0.10 psi) and shall have an accuracy of four hundredths of one pound per square inch (0.04 psi). Accuracy and calibration of the gauge shall be certified by a reliable testing firm at six (6) month intervals or when requested by the Engineer.

A physical inspection of the pipe may also be made. In such case, the Contractor shall furnish adequate blowers and ventilation equipment to allow passage of personnel through the pipe. The Contractor shall promptly repair all defects in workmanship noted in the inspections.

c. Video Inspection: The Contractor shall furnish video inspection of the newly installed storm and/or sanitary mains. The video inspection shall be made after required leakage and deflection tests have been completed and before trench resurfacing. Prior to performance of the camera inspection, the Contractor shall flush the lines with water to provide indication of high or low spots in the flowline grade. The inspection shall be recorded in true color in VHS (“SP”) cassette or DVD format. The camera resolution shall be of a quality that will allow pipe joints to be inspected, imperfections in the pipe to be noted and any sag to be detected. The camera equipment shall also provide on screen footage, date, and time indication.

A written log shall accompany the recorded inspection. The following information shall be included:

i. Date
ii. Tape Number
iii. Location
iv. Pipe Material and Size
v. Name of Equipment Operator
vi. Name of Firm Performing the Inspection
vii. All deficiencies in the pipe and installation shall be noted and their location referenced to their on-screen footage readout.

The testing company shall provide a map of the tested pipe. Information provided shall clearly correlate between pipeline plans and the recorded video inspection. Lateral lines shall be documented by stationing from centerline of manholes.

Within twenty-four (24) hours of the completion of the video test a copy of the test and the log shall be delivered to the Engineer. The video test and log shall become the property of the City of Visalia.

The City shall be the sole judge as to the acceptability of construction revealed by the video inspection. Any broken, damaged, or deficient pipe, any separation or offset of joints, any pipe exceeding the tolerances for line, grade, or deflection, and any infiltration points shall be replaced or repaired at the Contractor's expense. The repair will then be re-inspected at the Contractor's expense until the repair is satisfactory.

17.12 BEDDING

Bedding for all pipe, unless specified otherwise in these Standard Specifications or the Special Provisions, shall conform to the requirements of Section 12.06 of these Standard Specifications.

17.13 BACKFILL

Backfill for all pipe, unless specified otherwise in these Standard Specifications, shall conform to the requirements of Section 12.06 of these Standard Specifications.

17.14 PROTECTION OF PIPE

The requirements of this Section 17 shall not relieve the Contractor of the provisions of Section 7.12 of these Standard Specifications.

The Contractor shall exercise every precaution against damage to the pipe, including damage from subsequent backfill or compaction operations. Any damaged pipe shall be removed from the work or repaired as directed by the Engineer.

17.15 WATER/SEWER SEPARATION

Water and sewer mains and house services shall maintain minimum vertical and horizontal separation between each other as required by Title 17 of the State of California Administrative Code, Section 7081 (b).

17.16 PAYMENT

The length of pipe to be paid for will be the slope length designated by the Engineer. When pipes are laid through structures as shown in the Engineering Improvement Standards or as directed by the Engineer, the payment quantity will include those quantities within the

structure. When pipes begin and/or terminate at structures, the payment quantity shall be exclusive of structures. When pipes enter a structure from a right angle and are cut to conform to the faces of the structure or of a slope, the quantity to be paid for will be measured along the center line of the pipe to the inside face of the structure, or to the face of the slope.

The price paid per linear foot of pipe shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, including, but not limited to, all fittings and couplings as may be required, and doing all work involved in installing the pipe complete and in place, including, but not limited to, excavation and backfill, and for all tests as herein specified, all as shown in the approved Construction Drawings, as specified in these Standard Specifications, in the Special Provisions, and as directed by the Engineer.

SECTION 18 - BORING AND JACKING PIPE

18.01 GENERAL

a. Description of Work:

This work encompasses the work required to install a casing pipe by boring and jacking.

b. Job Conditions:

i. Protection of Existing Underground Utilities:

(a) The locations of existing utilities are shown in the approved Construction Drawings based upon information and data supplied by the City or by the Owner of the utility. The utilities are shown in the approved Construction Drawings for information only and are not guaranteed to be either complete or accurate. It is the Contractor's responsibility to contact all utilities and USA to locate utilities prior to construction.

(b) Any damaged caused to existing utilities shall be reported to the appropriate utility and repaired in accordance with the utility's standards.

(c) The cost to repair/replace damaged utilities shall be borne by the Contractor.

(d) If an interruption of utility service results from accidental damage, the Contractor shall take immediate steps as necessary to notify the utility and restore service. Contractor's personnel shall not leave the site until the interruption has been restored.

ii. Work Within Railroad or Utility Right-of-Way:

(a) When the Contractor is performing work within the right of way of other jurisdictions such as railroads or utilities, such work shall comply with applicable permits or regulations of such jurisdictions.

18.02 MATERIALS

a. Casing Pipe:

i. Casing Pipe: Welded steel pipe ASTM A-139, Grade B, with minimum thirty five thousand pounds per square inch (35,000 psi) yield strength. Casing shall not be spiral welded. All casing lengths shall be equal to the auger length.

ii. Carrier Pipe: As indicated in the approved Construction Drawings.

iii. The encasing pipe shall be clean and coated on the outside with two (2) coats of coal tar epoxy: Carboline Bitumastic 300M Coal Tar Epoxy Coating or equal.

iv. Unless noted otherwise in the approved Construction Drawings, steel casing pipe shall have a minimum wall thickness as noted in the following Table. Larger casing pipe maybe substituted at no additional cost to the City.

Minimum Wall Thickness for Steel Casing Pipe for H25 and E80 Loading

	Wall Thickness, Minimum Inches	
Nominal Diameter (inches)	Under Highway (inches)	Under Railroad (inches)
12 ¾ and under	0.188	0.188
14	0.188	0.250
16	0.188	0.281
18	0.250	0.312
20 and 22	0.250	0.344
24	0.281	0.375
26	0.281	0.406
28	0.312	0.438
30	0.312	0.469
32	0.312	0.500
34	0.312	0.5312
36	0.344	0.5625

b. Spacers/Skids:

PVC casing spacers may be used for all installations.

PVC casing spacers shall be attached to the conduits with stainless steel straps to center the pipe in the casing. The spacers shall prevent appreciable movement of the conduit up or down or sideways within the casing. Spacers shall be placed every four feet (4') on center throughout the steel casing.

Redwood Skids may be used instead of spacers. Skids shall be comparable quality and functionality, spaced at four feet (4') on center.

18.03 EXECUTION

a. General:

The conduit shall be installed by jacking into place. Earth displaced by the conduit shall be removed through the interior of the conduit by hand, by auger, or by other acceptable means. Sections of the casing pipe shall be welded together with a continuous circumferential weld to form a continuous conduit capable of resisting all stresses, including jacking stresses. Any other facilities required, or any other additional reinforcement of strength of casing pipe required to withstand jacking pressures shall be determined and furnished by the Contractor at his expense. The casing pipe conduit, in its final position, shall be straight and true to alignment and grade, as required by the approved Construction Drawings.

Completed bore holes shall not exceed the outside diameter of the casing by more

than one inch (1"). When material tends to cave in from outside these limits, a shield shall be used ahead of the first section of pipe or face of excavation shall not extend beyond the end of the pipe more than one and one-half feet (1½'), unless otherwise permitted by the Engineer. All voids outside this limitation shall be completely filled by grouting or other remedial measures approved by the Engineer.

Casing pipe shall be so constructed as to prevent leakage of any substance from the casing throughout its length except at ends. Casing shall be so installed as to prevent the formation of a waterway under the roadway, with an even bearing throughout its length, and shall slope to one end. Each end of the casing shall be plugged with ungrouted bricks or other suitable material approved by the Engineer. Dry sand shall then be blown into fill the annular space between the carrier pipe and casing and an ungrouted brick plug shall be placed in the unplugged end. Plugs shall not make a tight seal.

b. Excavation:

The Contractor shall provide temporary support of pit facings as necessary to protect personnel, equipment and public. If a larger pit is required, it shall be approved by the Engineer. Guard rails and other required safety devices shall be maintained on all sides of the jacking pit as directed by the Engineer. Such guard rails shall not extend beyond the limit of the jacking operation. The jacking pit shall be considered as the immediate twenty feet (20') approaching the point where the first pipe to be jacked enters the earth.

No earth or construction materials shall be dragged or scraped across the street pavement, and no excavated earth shall be placed or allowed to remain at a location where it may be tracked on the street traveled way, or any public or private approach by the Permittee's construction equipment, or by traffic entering or leaving the street traveled way. Any excavated earth or mud so tracked onto the street pavement or public private approach shall be immediately removed by the Permittee.

All pits should have crushed-rock and sump areas to clear groundwater and water used to clean the casing. Where ground water is found and pumping is required, the pits shall be lined with filter fabric.

This work shall consist of furnishing, boring, and jacking into place the type of pipe shown in the approved Construction Drawings or specified in the Special Provisions at locations and between the limits shown in the approved Construction Drawings or specified, and in accordance with these Standard Specifications.

18.04 EXCAVATION OF JACKING AND RECEIVING PITS

Jacking and receiving pits shall be excavated and sheathed, shored or braced in accordance with the Safety Regulations of the State of California, Department of Industrial Relations, Division of Industrial Safety, and in accordance with Section 7.19 of these Standard Specifications.

18.05 BACKFILL OF JACKING AND RECEIVING PITS

Jacking and receiving pits shall be backfilled in accordance with Sections 12.06 of these Standard Specifications.

18.06 PAYMENT

The price paid per linear foot of pipe, shall include full compensation for furnishing all labor, materials, tools and equipment, and doing all the work involved in furnishing and installing the pipe in place, including, but not limited to, excavating, constructing and backfilling jacking and receiving pits, constructing metal shields (jacking heads), and backfill of voids or cavities, all as shown in the approved Construction Drawings, as specified in these Standard Specifications, in the Special Provisions, and as directed by the Engineer.

SECTION 19 - SEWER AND STORM DRAIN STRUCTURES

19.01 DESCRIPTION

This work shall consist of constructing Portland Cement Concrete sewer and storm drain manholes, storm drain inlets and outlets and any miscellaneous structures appurtenant to sewers and storm drain all complete and in place at the locations shown in the approved Construction Drawings, the Engineering Improvement Standards, as specified in these Standard Specifications, and in Section 51 of the State of California Standard Specifications.

19.02 MANHOLES AND MATERIALS

a. Manholes: Manholes shall consist of a poured-in-place concrete base section, (except as otherwise provided by the Engineering Improvement Standards), a pre-cast or cast-in-place riser.

Section, a reinforced concrete taper section, grade rings, cast iron frame and cover, and poured-in-place concrete collars.

Where specified in the approved Construction Drawings or directed by the Engineer, manholes shall be left a minimum of one foot (1') and a maximum of eighteen inches (18") below final finish grade of streets or other areas to be reconstructed or where new streets or other facilities are to be constructed. The manhole frame and cover shall be temporarily set as specified by the Engineer. Unless otherwise specified, the Contractor will be required to raise these manholes to grade in accordance with the Engineering Improvement Standards for raising manholes to grade, including returning after construction or reconstruction of streets or other areas, shall be included in the price paid per manhole, and no additional payment will be made unless a bid item is provided therefore.

Where existing manholes need to be raised or lowered to meet a new street grade, they will be lowered below the grading plane as specified in Section 12.02 of these Standard Specifications and marked until the street has been paved. After the paving material has been compacted, they will be dug out, the frame and cover removed and raised to grade as shown in the Engineering Improvement Standards.

In all cases where manhole covers are to be brought to grade in areas with existing pavement, the repair shall be done in accordance with these Standard Specifications Sections 13 and 14 and shall equal in thickness and quality with the type of base, if any, and paving, that was existing or in accordance with the trench resurfacing requirements for the pipeline construction.

b. Materials: Concrete and mortar shall conform to the requirements of Section 10, "Portland Cement Concrete, Cement Mortar" of these Standard Specifications. Concrete for base and cast-in-place riser sections shall be Class 2.

Pre-cast riser sections, tapered cones of flat tops, and grade rings shall be reinforced concrete and shall conform to ASTM Designation: C478, using Type II cement.

c. Manhole Frames and Covers: Manhole frames and covers shall be twenty four inch (24") Identify Wilkerson and Nutwell or approved equal, and shall be of tough gray iron conforming to the specifications of the ASTM, A 48-48 for Class No. 30 castings, with the exception that no traverse test will be required. The bearing surfaces of manhole frames and covers shall be machine for bearing and the cover shall seat firmly into the frame without rocking. All castings shall be heavily coated with asphaltum paint with the exception of machines surfaces.

   All manhole covers shall be marked "City of Visalia", "Storm Sewer System" or "Sanitary Sewer System" as shown in the approved Construction Drawings.

d. Construction: Manholes shall be constructed in accordance with the Engineering Improvement Standards and as herein specified.

   All entering and leaving storm drain pipes shall be placed flush with the inside edge of the manhole.

   The base of sewer manholes shall be formed to create invert channels which shall be smooth and semi-circular in shape conforming to the size and flow line of the entering and leaving pipes.

   If a sewer main is laid through a manhole, the top of the pipe shall be carefully broken out and removed, leaving the bottom half of the pipe to form the flow line of the manhole. Rubber 'O' rings are required where PVC pipe is joined to concrete manholes.

   Changes in size and grade of invert channels shall be made gradually and evenly. Changes in direction shall be made with a smooth curve of as large of a radius as the size of the manhole will permit.

   The top of the base section shall be keyed to receive the tongue end of the riser section. The key shall be formed in the freshly poured concrete by using a template manufactured to the dimensions of the riser section. If the riser is cast-in-place monolithically with the base section by using a slip form or other means, the key may be omitted between the base and the riser. If the base and riser sections are not poured monolithically but separately, a key shall be provided in the base section. In either case, a key will be required in the top of the riser section to receive the tongue end of the tapered cone. Cast-in-place riser sections shall have the minimum wall thickness specified in the Engineering Improvement Standards.

   The joints between the base and all pre-cast elements of the manhole, including adjustment rings and manhole frame, shall be filled with cement mortar prior to joining the elements.

   The interior of the manhole shall be troweled smooth with a wooden trowel, removing excess mortar extruded out of joints for the entire height of the manhole, from the manhole frame to the floor. All excess mortar and any other debris shall be removed from the manhole.

e. Raising to Grade: Manholes constructed in finished roadway areas, or other finished areas, shall be brought to the same elevation as the surrounding finished surface in accordance with the Engineering Improvement Standards.

f. Abandoning Manholes: Manholes abandoned in place shall be broken out within two feet (2') of the finished grade. The manhole frame and cover will be delivered to the City Corporation Yard. Any pipes entering the manholes shall be sealed with concrete and the manhole backfilled with sandy soil and compacted to a relative compaction of ninety-five percent (95%) using optimum moisture and tested in accordance with Test Method No. California 216. Tests shall be provided in accordance with Section 6.02 of these Standard Specifications.

Manholes to be removed shall have the barrel and tapered section removed and the base broken up and disposed of. The manhole frame and cover will be delivered to the City Corporation Yard. After the complete manhole has been removed, the excavation will be backfilled in accordance with backfill requirements. Before backfilling, all sewer or storm drain pipes that have entered the manhole will be sealed with concrete. The cost of plugging existing pipes shall be included in the cost of removing the manhole and no additional payment will be made therefore.

19.03 STORM DRAIN INLETS AND OUTLETS

a. Materials: Concrete and mortar shall conform to the requirements of Section 10, "Portland Cement Concrete, Cement Mortar" of these Standard Specifications. Concrete shall be Class 2 using Type II Cement.

All metal parts shall be structural grade steel, except those permitted to be cast iron by the approved Construction Drawings or the Engineering Improvement Standards, and bar reinforcement shall conform to the requirements of Section 52, "Reinforcement" of the State of California Standard Specifications. All exposed metal parts, unless otherwise specified, shall be hot dipped galvanized approved by the Engineer.

b. Forms: Forms shall conform to the requirements of Section 10.07 of these Standard Specifications. The Contractor shall not place concrete in any forms until the forms have been approved for line and grade by the Engineer.

c. Construction: Storm drain inlets or outlets may be constructed either by completely forming the interior and exterior of the structure, or by forming only the interior and upper section and neat pouring concrete for the lower section against undisturbed earth that has been excavated to the lines and grades indicated in the approved Construction Drawings or as directed by the Engineer.

Storm drain inlets and outlets shall be constructed monolithically (one pour), or if the Contractor elects, the structures may be constructed in two sections (two pour), with no additional payment made therefore. Rubber 'O' rings are required where PVC pipe is joined to concrete manholes or storm drain inlets.

The surface finish of the exterior exposed surfaces of concrete shall conform to the

sidewalk, curb and gutter finish as required in Section 16.10 of these Standard Specifications. The interior surface shall have a wood trowel finish. Excessive voids shall be chipped and repaired as directed by the Engineer.

Depths of the storm drain inlets and outlets may vary according to the depth and grade at which the lateral pipe must be installed in order to avoid existing utilities. The Contractor shall allow in his bid price for the various inlet or outlet structures full compensation for any possible increase or decrease in the anticipated depth because of adjustment in depth of lateral pipes.

Lateral pipes connecting to storm drain inlets and outlets shall be installed flush with the inside walls of the structure.

Existing concrete work shall be removed and replaced as necessary to install proposed inlets and outlets, with full compensation therefore included in the unit price bid for said inlets and outlets.

A concrete pavement saw shall be used, unless determined to be impractical by the Engineer or unless some other method approved by the Engineer, such as removal of concrete to an adjacent expansion joint, obtains as satisfactory a result as saw cutting in removing of all existing concrete pavements, curbs, gutters, and sidewalks. A minimum of one and one-half inch (1½") depth of saw cut shall be used.

No separate payment shall be made for concrete saw cutting and full compensation therefore shall be included in the various bid items of work involving saw cutting.

Grading work in the immediate vicinity of the installed inlet structures shall be done by the Contractor as directed by the Engineer so as to provide for the movement of surface water to the newly installed inlet. Full compensation for said grading work shall be included in the price bid for inlet structures, and no separate payment will be made therefore.

At locations where inlets and outlets are constructed behind curb lines and within landscaped areas, all structure patching, final backfilling, final sprinkler system repairing and lawn reseeding and mulching behind the curb line shall be completed within fifteen (15) calendar days of placing the structure.

Where it is necessary to construct the curb and gutter portions of storm drain inlets and outlets on disturbed earth, a foundation for the curb and gutter shall be prepared by thoroughly compacting the disturbed material to the satisfaction of the Engineer.

19.04 MISCELLANEOUS STRUCTURES

a. Materials: Concrete and cement mortar shall conform to the requirements of Section 10 "Portland Cement Concrete, Cement Mortar" of these Standard Specifications. Concrete shall be Class 2, unless otherwise specified.

Bar reinforcement shall conform to the requirements of Section 52, "Reinforcement" of the State of California Standard Specifications. All metal parts shall be of structural grade steel, except those parts that may be cast iron as provided by the details in the approved Construction Drawings or the Engineering Improvement Standards.

All exposed metal parts, except as provided below, or unless otherwise provided in these Standard Specifications or the Special Provisions, shall be painted or dipped with an asphaltum paint approved by the Engineer.

Exposed metal parts for all outfall cages shall be galvanized by the hot dip method with the large pieces meeting the requirements as set forth in ASTM Designation: A123, and nuts, bolts and small pieces meeting the requirements as set forth in ASTM Designation: A153.

b. Construction: Miscellaneous facilities shall be constructed in accordance with the applicable portions of the Sections 19.02 and 19.03 of these Standard Specifications, and in accordance with the details and notes in the approved Construction Drawings or the Engineering Improvement Standards, or as directed by the Engineer.

The surface finish of the concrete shall conform to the sidewalk finish required in Section 16.10 of these Standard Specifications, or as required by the Engineer. The interior surface of the concrete shall have a wood trowel finish.

The cost of connecting storm drain or sewer laterals or pipelines to miscellaneous facilities shall be included in the prices bid for the various items of work requiring the connections and no additional compensation will be paid therefore.

19.05 EXCAVATION

Excavation for all structures shall conform to Section 12.05 of these Standard Specifications.

19.06 FORMS

Forms shall conform to the requirements of Section 10.07 of these Standard Specifications.

19.07 BACKFILL

Backfill for all structures shall conform to the requirements of Section 12.06 of these Standard Specifications.

19.08 CURING

Curing of exposed concrete surfaces shall comply with the requirements of Section 10.08 of these Standard Specifications.

19.09 PAYMENT

Payment for all structures, unless otherwise specified in the Special Provisions, will be made on a unit price per each basis and shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and doing all work involved in constructing the structure in place complete, including, but not limited to, any and all structural elements, frame and cover assemblies, removal of existing concrete, excavation for the structure, excavating, connecting, existing or new lateral or main pipes, unless specified otherwise herein, and backfilling, all as shown in the approved Construction Drawings, the Engineering Improvement Standards, and as specified in these Standard Specifications, the Special Provisions, in the California Standard Specifications, and as directed by the Engineer.

SECTION 20 – SEWER PUMP STATION

20.01 GENERAL

All work involved in constructing sewer pump stations shall conform to the applicable provisions of the State of California Department of Transportation Standard Specifications, City Standards, the Engineering Improvement Standards and these Standard Specifications.

The following specifications represent the minimum specifications allowable for a duplex sewer pump station. Additional features or specifications may be required as needed.

20.02 REINFORCED CONCRETE

a. Scope of Work: The work included herein shall conform to Section 51 "Concrete Structures" and Section 90 "Portland Cement Concrete" of the State of California Standard Specifications. This work shall consist of furnishing all labor, tools, equipment and materials necessary for the installation of all structural concrete, minor concrete and mortar as shown in the approved Construction Drawings and specified in these Standard Specifications.

b. Structural Concrete:

   i. Strength: The minimum ultimate twenty-eight (28) day compressive strength of all structural concrete shall be three thousand two hundred fifty pounds per square inch (3,250 psi).

   ii. Concrete Mix: All structural concrete shall be Class 2 (590 pounds of cement/cubic yards of concrete) with Type II Portland Cement. The maximum size of aggregate shall be one and one-half inches (1½").

   iii. Slump: The amount of water used for mixing (including free moisture carried by the aggregate) shall not exceed the maximum necessary to produce a four inch (4") slump as determined by ASTM test method C143.

   iv. Placing: Concrete shall be placed in accordance with Section 51-1.09 "Placing Concrete" of the State of California Standard Specifications.

   v. Forms: All formwork shall conform to Section 51-1.05 "Forms" of the State of California Standard Specifications.

c. Defective Concrete: Concrete not meeting the minimum strength requirement, not formed as indicated, not true to intended alignment, which has large voids or rock pockets, which has wood or other debris embedded which has a surface deviation greater than one-eighth of one inch (⅛") in ten feet (10'), or does not fully conform to these Standard Specifications shall be deemed defective, and if so directed by the Engineer, shall be removed and replaced with concrete complying with the drawings and these Standard Specifications.

d. Minor Concrete:

i. Concrete Mix: All minor concrete shall be Class 2 (590 pounds of cement/cubic yards of concrete) with Type II Portland Cement. The maximum size of aggregate shall be one inch (1").

ii. Formwork: Earthen forms for exterior concrete surfaces shall be allowed only upon approval by the Engineer. The acceptability of the earthen forms shall be solely decided upon by the Engineer.

e. Mortar: All mortar shall conform to Section 51-1.135 "Mortar" of the State of California Standard Specifications.

f. Non-Shrink Grout and Drypack: Non-Shrink grout shall conform to Section 50-1.09, "Bonding and Grouting" of the State of California Standard Specifications with a required admixture using the following proportions:

Portland Cement	1 part by Wt.
Sand (100% Passing #8 Sieve)	1 part by Wt.
Water	4 V2 - 5 V2 gal./sack cement
Sika "Intraplast" N Admixture	1 % by Wt. of cement

Drypack shall be composed as for grout, except that only enough water shall be added to wet the mixture (no free water and no slump). Drypack shall be tamped into place and cured as specified for concrete in this Section.

Contractor shall not use non-shrink grout or drypack that has been mixed longer than thirty (30) minutes. No retemping shall be allowed.

g. Finishes on Walking Surfaces: The Contractor shall give a monolithic finish to the walking surfaces at all concrete floors and slabs within and adjacent to the structures which are to be constructed under this contract. All concrete surfaces to be so finished shall be thoroughly worked, brought to a uniform smooth finish and given a final brush finish.

h. Curing: All newly placed concrete shall be kept moist for the first seven (7) days after the concrete has been placed. This shall be achieved by one of the following methods:

i. Ponding.

ii. Cotton mats, rugs or carpets kept continuously wet.

iii. Kraft paper or plastic film with joints dealing or tapered. The perimeter of the paper shall be sprinkled once daily.

iv. Curing compound method: All exposed cast in place concrete shall be cured with white pigmented curing compound (State Spec. 8030-71 D-05, Type 1) in accordance with Section 90-7 "Curing Concrete" of the State of California Standard Specifications.

Forms may be used to cure formed portions in accordance with Section 90-701D "Forms-In-Place Methods" of the State of California Standard Specifications. If the forms are removed prior to seven (7) days after the pour, the newly exposed areas shall be cured for the remainder of the seven (7) days by one of the above methods.

20.03 METAL WORK

a. Scope of Work: The work included herein shall conform to Section 52 "Reinforcement", Section 55 "Steel Structures" and Section 75 "Miscellaneous Metal" of the State of California Standard Specifications. This work shall consist of furnishing all labor, tools, equipment and materials necessary for the installation of all reinforcing steel, structural steel and miscellaneous metal as shown in the approved Construction Drawings, as specified in these Standard Specifications and as directed by the Engineer.

b. Reinforcing Steel:

i. Materials:

(a) Bars shall be deformed bars conforming to ASTM A-615, as follows:

Bar Size	Grade
#4 and smaller	40
#5 and larger	60

(b) All reinforcing steel shall be new, clean, free from oil, dirt, loose mill scale, excessive rust, mortar, or other coatings that would destroy or reduce the bond.

c. Placing Reinforcement: The bending and placing of all reinforcement shall conform to the "Manual of Standard Practice" of the American Concrete Institute. Bends shall be made around a pin having a diameter of not less than four (4) times the bar diameter for stirrups and ties, six (6) times the bars except for bars larger than one inch (1") which shall be eight (8) times the bar diameter. Bars shall be bent cold.

Reinforcing shall be accurately placed in accordance with the drawings and shall be securely tied in position with at least sixteen gauge (#16) annealed wire at all bar intersections. Metal chairs and bolsters shall be used to hold all steel above the form bottoms at the proper distance. Metal spacers shall be used to secure the proper spacing of the steel. Precast concrete blocks shall be used to support reinforcing steel off the ground in footings and off the soffit of concrete exposed to weather. The clear distance between parallel bars shall not be less than one-half of one (½) times the bar diameter, but in no case less than one-half of one inch (½") nor less than one and one third (1⅓) times the maximum size of coarse aggregate.

Splices shall be made with a lap of at least thirty (30) bar diameters unless noted otherwise. The bars shall be placed in contract and wired together in such a manner as to maintain a clearance of not less than the minimum clear distance to the other

bars and to the surface of the concrete. Minimum clear distance to all concrete surfaces shall be two inches (2") unless otherwise noted in the approved Construction Drawings.

d. Pump Access Covers: The wet well shall be equipped with a pump access cover for each pump as shown in the approved Construction Drawings. Access covers shall be stainless steel-fitted aluminum construction, designed for access to submersible pumps. Covers shall be equipped with a guide bar bracket, safety chain hook, electric cable support, and a hasp for a padlock. Covers shall be of a size compatible with the pumps.

e. Valve Box Access Cover: Cover shall be double leaf, channel frame aluminum construction with stainless steel hardware and a hasp for a padlock. Cover shall be of a size compatible with valve box opening, minimum size shall be five feet by six feet (5' x 6') with each leaf being three feet by five feet (3' x 5'). The cover shall withstand a live-load of at least three hundred pounds per square foot (300 psf) and be equipped with spring door operators and automatic hold open arms. The cover construction shall have a mill finish with Bituminous Coating applied to exterior of the frame.

f. Anchor Bolts and Concrete Anchors: Concrete anchorage devices shall be installed in the concrete as shown in the approved Construction Drawings so that the attached equipment will bear firmly against the concrete. The concrete anchors for the pump discharge mount shall be RED HEAD RED-CHEM STAINLESS STEEL CONCRETE ANCHORS # CHEM-2034, three-fourths of one inch (¾") diameter, or approved equal.

g. Bolted Connections: All bolts, nuts and washers within the wet well shall be stainless steel.

20.04 PAINTING

a. Scope of Work: Under this item, the Contractor shall furnish and apply to the satisfaction of the Engineer, protective paint in colors as selected by the Engineer. All exposed interior and exterior metal surfaces, except aluminum, galvanized steel, stainless steel and chrome plated metal, shall be coated.

All paint shall be delivered in original containers and shall be applied in strict accordance with the recommendations of the manufacturer.

b. Preparation of Surfaces:

i. Concrete Surfaces: Before painting, all concrete surfaces to be painted shall be thoroughly cleaned. Surfaces to be painted shall be completely wire brushed to remove any loose concrete or paint, and cracks shall be patched. Concrete surfaces to be painted shall have all air pockets or other imperfections filled, so that a smooth surface results. All surfaces shall be completely dry prior to painting.

Concrete surfaces which shall be coated with a protective coating for the purpose of protecting the concrete surface, shall have all air pockets or other imperfections in the concrete filled, so that a smooth concrete surface results, after the surface has been opened, it shall be accomplished soon after the removal of the forms to promote adequate adhesion. Covering over the surface with a thin layer of mortar shall not be acceptable.

ii. Metal Surfaces: All metal work to be painted shall be absolutely clean and free of all rust and grease.

All exposed cast iron or steel piping to be painted, which has a previously applied coal tar derivative, shall be primed, prior to finish coating, with two (2) coats of Koopers "Tarstop", or approved equal.

iii. Completion of Surface Preparation: After the Contractor has completed the job of preparing all surfaces to be painted, the surfaces shall be inspected and approved by the Engineer prior to the application of any protective coatings.

c. Materials: Under these Standard Specifications, all paint products to be furnished for application shall be as manufactured by Koppers, or approved equal.

d. Coating System:

i. One (1) coat of Bitumastic #50 M. The completed surfaces shall have a dry thickness of at least 16 mil.

ii. Two (2) coats of Bitumastic #300 M. First coat to be red, second coat to be black. Application of second coat to be applied within twenty-four (24) hours of the first. The completed surfaces shall have a dry thickness of at least sixteen millimeters (16 mil).

iii. One (1) coat of 622 Rust Penetrating Primer followed by two (2) coats of Glamortex 501 Enamel, color: OSHA Safety Blue.

iv. The completed surfaces shall have a dry thickness of at least three millimeters (3 mil).

e. Exterior Concrete Painting: Coating System "i" above, shall be used to paint the wet well and valve box exterior surfaces in contact with the soil.

f. Interior Concrete Painting: After surface preparation, the Contractor shall paint all submerged concrete surfaces, surfaces exposed to sewage fumes, all valve box interior, with Coating System "ii" above.

g. Wet Well Metalwork Painting: All exposed metalwork surfaces which are submerged or subjected to sewage fumes shall be painted with Coating System "ii" above. Metal located within water containing compartments shall be considered submerged. The pumps, pump discharge, pump power cables and lifting cables are not to be coated. Also the access covers are not to be coated.

h. Valve Box Metalwork Painting: All exposed metalwork surfaces in the valve box shall be painted with Coating System "iii" above. The access cover is not to be coated.

20.05 PIPEWORK

a. Scope of Work: Under this Section, the Contractor shall furnish all labor and materials for, and shall install, complete and test as specified, all pipework and appurtenances constructed under this contract.

Shop drawings are required to be submitted by the Contractor to the Engineer for all fabricated pipework, valves and special fittings.

b. Materials:

i. PVC Gravity Sewer Pipe: PVC sewer pipe shall conform to City standards and the requirements of ASTM D 3034, SDR 35, and shall have gasketed joints.

ii. PVC Force Main: PVC force main shall conform to AWWA C900 and shall be class 150. Ductile Iron Pipe (D.I.):

Ductile iron pipe and fittings shall be cement mortar lined. Pipe joints shall be flapped or as shown in the approved Construction Drawings. Applicable sections of the following standards apply.

Standard	Item
AWWA C151	Ductile Iron Pipe
AWWA C104	Cement Mortar Lining
AWWA C110	Fittings
AWWA C111	Rubber Gasket Joints

iii. Cast lion Fittings (C.I.): Cast iron fittings shall be in accordance with the AWWA Standard C 110-77, "Gray Iron and Ductile Iron Fittings, three inch through forty-eight inch (3"-48"), for Water and other Liquids".

iv. Couplings and Flanges: In the locations shown in the approved Construction Drawings, flanged coupling adaptors shall be Ford Style FFCA and flexible couplings shall be Ford Style FCI or approved equal.

Flanges shall be of a size and pattern to fit valves and other piping to which they are to be connected.

v. Small Piping and Fittings: These Standard Specifications shall apply to all metal pipe four inches (4") in diameter and smaller, other than cast iron piping, and shall also apply to all valves and cocks, unions, fittings, and connecting devices, and to pipe lines furnished as a part of the several piping and equipment items within the pump station. Small pipe shall include all nuts, bolts, gaskets, hangers, supports, the drilling of holes and flanges, and all materials and labor that may be necessary to the best installation of this class of

work.

(a) Fittings: All screwed fittings shall be "American Standard Malleable Iron Screwed Fittings", three hundred pounds (300 lbs) W.O.G. of standard form and dimensions. Malleable iron shall conform to current standard specifications for malleable iron.

Castings, as adopted by the ASTM. All fittings shall be galvanized to correspond with pipe on which they are installed.

All fittings necessary for the satisfactory alignment and arrangement of piping and all necessary unions and cleanouts shall be furnished by the Contractor.

vi. Gate Valve: All gate valves shall have standard flanged ends. Each valve shall have a two inch (2") square operating nut. Valves shall correspond in size with the run of pipe on which it is installed, except as otherwise noted. Gate valves shall be four inch (4") CLOW AWWA, F-5070, or approved equal.

vii. Swing Check Valve: Check valves shall be flanged, iron body, bronze-mounted check valves. Hinge pins shall be stainless steel or other noncorrodible metal, and the stuffing box assembly shall be made of bronze, securely screwed to the valve body. Swing check valves shall be Mueller check valves catalog number A-2600-6.02 or approved equal.

c. Pipework in Concrete: Where formed holes are left in the concrete, the Contractor shall be responsible for the accuracy of their location and for sealing around pipes to produce water tightness where necessary. He shall also provide any necessary pipeline openings through the concrete which may have been omitted.

d. Domestic Water Service: The Contractor shall provide and install all items as shown in the approved Construction Drawings and as needed to supply two inch (2") water service per City of Visalia Engineering Improvement Standards.

e. Reduced Pressure Backflow Preventer: The backflow preventer shall be a reduced pressure principle type and shall be suitable for supply pressure up to one hundred seventy-five pounds per square inch (175 psi). The backflow preventer shall be designated for inline servicing. The device shall be Febco Model 825Y for a two inch (2") service, or approved equal.

f. Domestic Water Spigots: Contractor shall supply one (1) spigot as shown in the approved Construction Drawings.

g. Wet Well Water Stops: All cored openings in the wet well wall shall be sealed with water stops secured by stainless steel bands and non-shrink grout as specified in Section 21.02.f of these Standard Specifications.

Water stops shall be Femco "Large Diameter Water Stops", or approved equal.

h. Discharge Wash-Down Assembly: Wash-down assembles as shown in the approved Construction Drawings shall use eight inch (8") by one inch (1") Tap Rockwell 323 Double Strap bronze saddles, or approved equal.

i. Wet Well Construction: Wet well shall be constructed using seventy-two inch (72") diameter, Class IV reinforced concrete pipe sections manufactured to meet ASTM Standards C76, C443, and C655. The wet well shall be constructed with no more than three (3) pipe sections. The lower wet well section shall be a minimum of six feet (6') in length.

   Interior surfaces shall be painted prior to the installation of pumps. The discharge connection mating surface shall be kept clean and free of all paint.

j. Sewer Manholes: The Contractor shall construct the sewer manholes as shown in the approved Construction Drawings, per the City of Visalia Engineering Improvement Standard "*60" Sanitary Sewer Manhole*".

20.06 MECHANICAL EQUIPMENT

a. Scope of Work: Under this Section the Contractor shall furnish and install all mechanical equipment and appurtenances for this project as shown in the approved Construction Drawings and hereinafter specified. All such equipment shall be placed by the Contractor in satisfactory operating condition as an integral part of the construction of the project.

   The Contractor shall provide and install all necessary items and appurtenances required for the proper placement and functioning of the project components as intended, whether such items and appurtenances are directly specified or not.

   All equipment shall be designed, manufactured and assembled in such a manner so as to perform satisfactorily within housings, enclosures and the environment into which it is to be installed and operated. All items shall be tested in place. Required supervision for installing, testing and starting shall be furnished by factory-trained personnel at no charge.

   These specifications include the supply and the installation of two (2) vertical, mixed-flow propeller, oil-flushed lubricated, enclosed line shaft pump. The unit shall include a bowl assembly, suction strainer, column, enclosing tube and lineshaft, discharge head, sealing assembly, and driver.

b. Quality Assurance: All pumping equipment furnished under these Standard Specifications shall be of a design and manufacture that has been used in similar applications with a minimum four (4) years of service.

   The unit, including the motor and all the accessories, shall be provided by the pump manufacturer to insure compatibility. A warranty and quality assurance program is required for all the components.

   Pump is to be engineered and manufactured under the certification of ISO-9001:2000.

The Contractor shall verify all actual dimensions of existing and new construction equipment areas, bases and mountings; and he shall be responsible for insuring proper fit of the equipment selected for installation. The Contractor shall be fully responsible for the compatibility of furnished mechanical, electrical, pipework and structural items and appurtenances.

c. Pump Warranty: The pump manufacturer shall warrant the pumps and motors being supplied to the Owner against defects in workmanship and materials for a period of one (1) year under normal use, operation and service. The warranty shall be in printed form and shall apply to all similar units.

d. Submersible Pumps, Motor and Slide-away Coupling: The Contractor shall furnish and install a totally submersible pump, as shown in the approved Construction Drawings and as described hereinafter. The pumping unit shall conform to the following characteristics:

(*Brand, size*) Model _____ Torque-flow vortex submersible pumps with _____ HP, _____ phase, _____ volt, _____ hertz submersible motors and slide-away casings.

Pump casing shall be constructed of ASTM A48 Class 30 grey iron and shall be completely open from suction to discharge with now wearing rings or impeller face plates required. All internal case clearances shall be equal to the discharge diameter so that all material which will pass through the discharge can pass through the pump.

The impeller shall be of the recessed design, constructed of ASTM A48 Class 30 grey iron and shall be mounted completely out of the flow path between the pump inlet and discharge connection, so that the solids pumped are not required to flow through the impeller. The impeller shall be keyed to the motor shaft and secured by an impeller bolt.

The motor shall be provided with thrust and radial bearings to carry the entire load which may be imposed upon it under all operating conditions. Motor shall be approved by Underwriters Laboratory for operation in a Class I, Group D, Division I hazardous location.

The motor shall have two (2) mechanical seals; the lower one outside the motor and protecting the upper one which is an oil-filled chamber. Moisture detector probes in the oil-filled seal chamber shall be connected to a customer-supplied alarm to indicate the presence of moisture in the seal chamber. Thermal over-load protectors shall be imbedded in the motor windings and connected to the starter to disconnect the motor in the event of overload.

The slide-away coupling shall consist of a foot-mounted discharge elbow and adaptor, steel baseplate, upper and lower rail supports, lifting yoke and cable. All metal to metal interfaces where movement might occur shall be non-sparking. The foot-mounted discharge elbow and adaptor shall conform to ASTM A48 Class 30 grey iron.

Lifting cable and hardware shall be stainless steel. Cable shall have a minimum working load of two thousand four hundred pounds (2,400 lbs.) and shall be supplied by the pump manufacturer.

e. Propeller: The propeller shall be of bronze construction conforming to ASTM B584, C83600. The propeller shall be of one-piece construction, mixed-flow, 3-vane. Vane leading edges shall be rounded to prevent accumulation of fibrous material. Propeller shall be statically and dynamically balanced to limit vibration and supported on both sides by sleeve-type bearings for stability.

   Propeller is to be secured to the shaft by means of a steel drive collet and lock nut to prevent axial movement.

   Propeller location within the bowl shall be adjustable by means of a top shaft-adjusting nut when utilizing a vertical hollow-shaft motor.

f. Bowls: The bowls shall be made of close-grained cast iron conforming to ASTM A48 CL30. Castings shall be free from blowholes, sand holes and shall be accurately machined and fitted to close dimensions.

   Bowls shall be flange connected.

   The bowl assembly shall include a cast iron suction bell of the flared inlet type incorporating a permanently grease-packed bronze bearing. The suction bell shall incorporate a minimum of three (3) guide vanes designed to minimize entrance losses and reduce vortexing.

   A bronze sand cap shall be provided to prevent entrance of sand into the suction bell bearing.

   The discharge bowl shall be provided with a bronze bearing immediately above the propeller as well as a bronze connector bearing.

g. Propeller Shaft: Propeller shaft shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel) designed to transmit the drive torque required.

   The shaft shall be supported by bronze bearings located on both sides of each propeller.

   Propeller shaft coupling shall be of carbon steel construction conforming to ASTM A108 GR12L14.

h. Column: Column pipe shall be straight, flanged and furnished in sections not over than eight feet (8') in length.

i. Line shafts: Line shafting shall be of ample size to transmit the torque and operate the pump without distortion or vibration.

   Line shafting shall be made of carbon steel conforming to AISI 1045 and be furnished in sections not over eight feet (8') in length.

Line shafting shall be coupled with extra-strong threaded steel couplings.

An enclosing tube shall be provided to house the lineshaft. It shall be of extra-strong ASTM A120, Schedule 80 pipe construction and furnished in interchangeable sections not over five feet (5') in length. Each end of the enclosing tube shall be machined to receive bronze connector bearings.

Enclosing tube connector bearings shall be of bronze material conforming to ASTM B505 C93200 material.

j. Discharge Head Assembly: The pump discharge head shall be cast iron with an ANSI 125# discharge flange.

The discharge head shall be of sufficient design to support the entire weight of the pump and driver.

A drive shaft of the same material as the lineshaft shall extend through the sealing assembly of the discharge head and be coupled to a vertical hollow shaft.

The shaft sealing assembly shall consist of a bronze tension box, cast iron packing gland, bronze connector bearing, stainless steel top shaft sleeve, stainless steel packing box washer, stainless steel packing gland nuts and bolts and synthetic packing.

Discharge head openings shall be fitted with guards to prevent injury from the rotating shaft and/or coupling.

k. Performance: Each pump shall be capable of operating at the following conditions:

First design point = _____GPM @ _____TDH.

Second design point = _____GPM @ _____ TDH.

(Maximum) shut off = _____ feet.

Impeller selected shall be capable of operating at all three (3) design points without exceeding BHP.

Minimum clearance through case = Inches

l. Pump Test: The pump manufacturer shall perform the following inspections and tests on each pump before shipment from factory:

i. Impeller, motor rating and electrical connections shall first be checked for compliance to the Customer's purchase order.

ii. A motor and cable insulation test for moisture content or insulation defects.

iii. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

iv. The pump shall be run for thirty (30) minutes submerged, a minimum of six feet (6') under water.

v. After operational test "iv" above, the insulation test "ii" above is to be performed again.

A written report stating the foregoing have been done shall be supplied with each pump at the time of shipment.

The pump cable end will then be fitted with a shrink fit rubber boot to protect it prior to electrical installation.

m. Documentation: Standard drawings supplied shall include pump outlines, controls, access frames and typical installation guides. Electrical control wiring diagrams shall be supplied. Instruction and maintenance manuals and pump parts lists for the pumps installed shall also be supplied.

n. Acceptance Tests: After installation, each pumping unit shall be given a running test, during which it shall demonstrate its ability to operate without vibration, overheating or excessive current draw, and to pump the capacity and head specified. These tests are to be conducted by the Contractor in the presence of the Engineer. The Engineer shall be given at least twenty-four (24) hours notice in advance of each test.

A certified factory performance test shall be performed on the bowl assembly in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to one hundred fifty percent (150%) of design flow. A minimum of six (6) points, including shutoff, shall be taken for each test. At least one (1) point of the six (6) shall be taken as near as possible to each specified condition.

During the tests, observations shall be made of motor input, vibration, noise and overheating to detect any defects in the equipment. Written results of each test shall be submitted by the Contractor to the Engineer prior to approval of the tested pumps.

The Contractor shall provide at his expense the necessary water, gauges, meters, piping and labor necessary for conducting the tests. All adjustments needed to place the equipment in satisfactory working order shall be made at the time of the tests. All defects or defective equipment revealed by or noted during a test shall be corrected or replace promptly at the expense of the Contractor, and if necessary, tests shall be repeated until satisfactory results are obtained.

In case the Contractor is unable to demonstrate to the satisfaction of the Engineer that the units will satisfactory perform the service required, and that they will operate free from vibration and over heating, the units may be rejected. The Contractor shall then remove and replace the equipment at his own expense.

20.07 ELECTRICAL WORK

a. Scope of Work: The Contractor shall provide all the required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, test equipment, and satisfactorily complete all the electrical work shown on the drawings and included in these Standard Specifications.

   The electrical work for this project includes providing all electrical materials and equipment required for a complete and fully operating facility. The Contractor shall provide temporary power for system testing.

   Included in this work is providing all required conduits, conductors, and cables including those specified; shown on the drawing; and neither specified nor shown on the drawings, but nonetheless required for satisfactory interconnection and operations of all electrical, mechanical and instrumentation equipment either shown on the respective drawings, specified in the respective portions of these Standard Specifications, or otherwise required.

b. Codes: All the electrical equipment and materials, including their installations, shall conform to the following applicable codes:

   i. National Electrical Code, Latest Edition

   ii. State Electrical Code, Latest Edition, Title 24 Part 3

   iii. Occupational Safety and Health Act Standards

   iv. City of Visalia California Municipal Code

c. Variances: In instances where two codes are at variance, the more restrictive requirements shall apply.

d. Standards: Equipment shall conform to the applicable Energy Information Alliance (EIA), Institute of Electrical and Electronics Engineers (IEEE), and National Electrical Manufactures Association (NEMA) Standards.

e. Drawings: The electrical drawings shall govern the general layout of the completed construction. Except where special details are used to illustrate the method of installation of a particular piece or type of equipment or materials, the requirements or descriptions in these Standard Specifications shall take precedence in the event of conflict.

f. Pump Station Control System: Contractor shall furnish and install the ultra sonic control for the two (2) pumps to be installed in the station. The system shall be the Milltronics Hydro Ranger 200 as described in manuals by Siemens Milltronics Process Instruments Inc., 1954 Technology Drive, P.O. Box 4225 Peterborough, Ontario Canada, K9J7B1. Enclosure shall be Type 4X/NEMA 4X/1P65 poly carbonate, nine and five-tenths inches by six and nine-tenths inches by three and five-tenths inches (9.5”x6.9”x3.5”). A.C. power shall be 240V ac, 50/60 Hz, 36 VA (17W). Fuse: F3: 2G, slow blow, 0.375A, 250V. Temperature sensor fuse F2:

Belling Lee, L754, 4000A HRC, ceramic type, 50mA, 250V. Mount enclosure at shoulder height in ambient temperatures between minus five degrees Fahrenheit (-5° F) to one hundred twenty-two degrees Fahrenheit (122° F) in relative humidity suitable for outdoors (Type/Nema 4X, IP65 enclosure). If mounted in secondary enclosure provide louvers and ventilation by fan to maintain ambient temperature within operating limits. Mounting to provide easy access for hand programmer and avoid exposure to direct sunlight and proximity to high voltage, current runs & variable frequency motor speed controls.

Output from the ultra sonic control system shall be to display, chart recorder, alarm, pump control, and to actuate the emergency power system for the stations operation.

Contractor shall furnish and install one (1) Ultra Sonic Milltronics Hydro Ranger 200 control system and control panel (conforming to NEMA 3R and 12 Standards) with a hinged inner door (dead front) fabricated from 5052-H32 eight-tenths of one inch (0.080") thick marine alloy aluminum. The inner door shall be held closed by two hand operated one quarter (¼) turn fasteners and shall contain the control instruments and indicators. The tamper proof outer door shall be lockable using a hasp. Ventilation shall be provided by air inlet louvers on one side of the enclosure together with a temperature activated cooling fan with capacity of sixteen cubic feet per second (16 ft^3/sec)., the thermostatically controlled fan shall be manually adjustable to turn on between ninety degrees Fahrenheit (90° F) and one hundred twenty-two degrees Fahrenheit (122° F) with a differential of not more than forty-three degrees Fahrenheit (43° F) between turn on and turn off. The cabinet fan circuit shall be fused at one hundred twenty-five percent (125%) of ampacity of the fan motor installed. The air inlet louvers and air outlet openings shall be located to direct the bulk of the air flow over the Hydro Ranger 200 Controller. Enclosure shall be a double compartment NEMA and contain space for service entrance equipment on the left side.

g. Control Panel: The entire control panel shall be UNDERWRITERS LABORATORY LISTED and furnished with a UL LABEL. Each component shall be factory mounted, wired, inspected and tested. A wiring diagram and heater chart shall be enclosed in the panel. A red "High Voltage Inside" nameplate shall be fastened to door covering the high voltage compartment. All components including indicating lights, switches, buttons, relays, accessories, and permanently identified as to their function with the components. The identifications shall be in the form of photo etching, silk screening or engraving. All terminal blocks shall be identified by both number and graphic symbols which clearly indicate the purpose of each terminal block. All control wiring shall be numbered at each termination. The panel enclosure shall be free standing and mounted on a reinforced concrete pad. The lower compartment shall have a lockable access door and be flush with the concrete pad.

The enclosure shall be constructed of fourteen gauge (#14) steel. The entire unit shall be degreased, cleaned and treated with a phosphatizing process, then primed and painted inside and out with corrosion-resistant, industrial-grade baked enamel. The finish coat shall be ASA-61 Gray.

h. Control System Operation: The control system shall provide total automatic control for two (2) motor driven pumps operating on _____ volts, _____ phase, wire service. The wet well level shall be monitored and controlled as follows:

Level 5 - High Level
Level 4 - Start Lag Pump
Level 3 - Start Lead Pump
Level 2 - Stop Lag Pump
Level 1 - Stop Lead Pump

Contingent upon the wet well level, the control system shall cause the liquid level indicator/controller to energize the appropriate control contacts. Upon wet well level rise, the lead pump start contact (Level 3) shall be energized causing a relay in the pump logic controller to start the lead pump. If the level continues to rise to the lag pump start control (Level 4), the controller shall energize a relay to start the lag pump, and both pumps shall run simultaneously. The liquid level shall be lowered until the lag pump stop contact (Level 2) is reached, stopping the lag pump. The lead pump shall continue to run lowering the wet well level until the lead pump stop contact (Level 1) is reached. Upon the next wet well level rise, the lead pump selection shall be alternated. If the wet well level rises to high level contact (Level 5), it shall energize a relay in the pump logic controller to operate the alarm system and indicate a high water condition.

The control system shall be built in such a manner that the Owner will have the ability to select high level alarm activation at a separate specific level or have it activated when start lag pump level is reached. The Owner shall have the ability to select independent start and stop for the lead and lag pumps, or a common stop for both pumps.

i. Liquid Level Indicator/Controller: The liquid level indicator/controller shall be equipped with manual testing capability located on the inner door. The operator shall be able to simulate rising and falling liquid level.

Monitoring and control of the liquid level in the wet well shall be by transducers installed in the wet well above the liquid as recommended by the manufacturers. The echo from the output at the transducer is processed back through to the Hydro Ranger 200 control panel and controller which generator outputs to relays in the control panel turning the pumps on/off as programmed as well as controlling programmed alarms and emergency power actuation.

j. Logic Controls: The duplex logic control system shall consist of the logic chassis mounted on the subpanel and the logic panel mounted on the dead front door. The logic chassis shall be a pre-wired assembly constructed of anodized aluminum containing logic and alarm circuits. The logic chassis shall interface with the wet well level liquid indicator/controller. The logic chassis shall contain a three (3) point terminal block for 120 VAC supply power, a power on-off switch for 120 VAC power, a 15 amp circuit breaker to protect 120 VAC power; a 120/240 VAC control transformer, a three (3) position lead pump selector switch that can operate in either “automatic alternation”; “lead pump #1 - Lag pump #2 - lag pump #1”

positions. Relays shall be square base, plug-in type, 3 pole double throw rated at 10 amp, 240 VAC with epoxy encapsulated coil and clear dust cover and shall be directly interchangeable. Five (5) LED status indicator lights shall be mounted adjacent to the relay sockets and wired in parallel with the relay coils to indicate that the power is applied to the coils. All relays shall have mechanical hold-down bales.

All terminals on the logic chassis shall be of the barrier clamp plate type rated at 15 amp at 300 VAC and accept two (2) fourteen gauge (#14) wires. Terminal blocks shall be provided for interfacing output from the liquid level indicator/controller to the logic chassis via a multi-conductor cable shall be identified with yellow heat shrink tubing with black nomenclature. Labels shall read as follows: High Level Alarm, Start Lag Pump, Start Lead Pump, Stop Lag Pump, Stop Lead Pump, and Common.

The logic panel shall be constructed of corrosion resistant anodized aluminum, and connected to the logic chassis via a multi-conductor cable. The logic panel shall be mounted on the inner door. The logic panel shall have the following components: Two (2) "hand-off automatic" selector switches for pumps, two (2) "pump run" green LED Indicators, one (1) 240 VAC "power on" yellow LED indicator, one (1) "start lag pump" yellow LED indicator, one (1) red push button for audible alarm silence, one (1) "high level alarm" red LED indicator and one (1) red push button for visible alarm reset. Provide two (2) 6-digit non-resetable, dust tight, oil tight and moisture resistant running time meters.

k. Back-Up System for Liquid Level Control: A backup control system shall be provided consisting of a system of float switches (SM-2 floats). The float system shall be turned on and off by one (1) switch at the control panel. The float switches (mercury switches) shall be installed at the water surface elevations shown in the wet well and coincide with actuating installed relays in the control panel turning the pumps on and off in the same sequence as the ultra sonic system. The float activated control system shall remain in the off mode till manually turned on at the control panel by a single switch.

l. Power Handling: Main lugs of the appropriate size shall be furnished for connecting the incoming supply power. The lugs shall be suitable for use with aluminum or copper conductors. Ground lugs of appropriate size shall be bolted to the sub-panel. Motor circuit protection shall be either type, shall contain a self test magnetic motor circuit protectors. Either type shall contain a self test "Trip Selector" permitting a mechanical simulation of the over current tripping device. The protector operating mechanisms shall be quick-mate, quick-break and trip-free type. Thermal magnetic breakers shall comply with Federal SPE.W-C 357a as Class Two breakers. Symmetrical amperes interrupting ratings shall be 10,000 amps minimum for 240 volt rated breakers and 15,000 amps minimum for 480 volt rated breakers. Magnetic motor circuit protectors shall provide instantaneous clearing of faults to a minimum of 10,000 amperes, RMS, symmetrical and shall have an adjustable instantaneous trip settings. Q-Frame type circuit breakers are not acceptable.

Circuit breaker toggles shall be operable through external extension handles that will interlock with the dead front door.

Each motor starter shall be NEMA rated, FVNR, with three (3) overload relays and reset button. The Contractor shall feature double break, silver cadmium oxide contacts, pressure type terminals, and barriers, free floating armature-magnet frame, molded continuous duty coils and stainless steel springs sized for the specific pumps supplied under this contract. Definite purpose Contractors, horsepower rated motor starters, and fractional NEMA sizes are not acceptable. Motor starter overload reset operators shall be reset without opening the dead front door.

A 100 watt strip heater and separate thermostat set at the appropriate temperature to prevent corrosion-causing condensation and freezing shall be supplied.

A control transformer, adequately sized for the connected load shall be provided on 3 phase, 3 wire system. The transformer shall be protected by fuses or circuit breaker. The control transformer may be eliminated on a 4-wire, single phase systems providing that the control voltage is protected by a circuit breaker and is wired per NEC Standards.

The unit shall be equipped with the capability to connect an emergency backup natural gas engine.

m. Optional Equipment: (As required) Provide a NEMA 4X, red lexan, break resistant globe and 75 watt lamp.

SECTION 21 – SIGNALS, LIGHTING, AND ELECTRICAL SYSTEMS

21.01 DESCRIPTION

Furnish and install all equipment, materials, and components for traffic signals and lighting system, pursuant to the provisions of the State of California Standard Specifications Section 86, "Signals, Lighting, and Electrical Systems", the Engineering Improvement Standards, these Standard Specifications and the Special Provisions. Where reference is made to Section 90, "Portland Cement Concrete", of the State of California Standard Specifications, the State of California Standard Specifications shall be used.

21.02 EQUIPMENT LIST AND DRAWINGS

The controller cabinet schematic wiring diagram and intersection sketch shall be combined into one (1) drawing so that when the cabinet door is fully open, the drawing is oriented with the intersection.

The Contractor shall furnish a maintenance manual for all supplied controller units, auxiliary equipment and vehicle detector sensor units, control units, and amplifiers. The maintenance manual and operation manual may be combined into one (1) manual. The Maintenance Manual or combined Operation and Maintenance (O&M) Manual shall be submitted at the time the controllers are delivered for testing or, if ordered by the Engineer, previous to purchase. The Maintenance Manual shall include, but need not be limited to, the following items:

a. Specifications,
b. Design characteristics,
c. General operation theory,
d. Function of all controls,
e. Trouble-shooting procedure (diagnostic routine),
f. Block circuit diagram,
g. Geographical layout of components,
h. Schematic diagrams,
i. List of replaceable component parts with stock numbers.

21.03 FOUNDATIONS

Portland Cement Concrete shall conform to Section 90-10, "Minor Concrete," of the State of California Standard Specifications and shall contain not less than four hundred seventy pounds (470 lbs.) of cement per cubic yard, except concrete for reinforced pile foundations shall contain not less than five hundred sixty-four pounds (564 lbs.) of cement per cubic yard.

21.04 MISCELLANEOUS CONCRETE CONSTRUCTION AND REMOVAL

Contractor shall coordinate traffic signal and lighting construction with access ramp construction to minimize the amount of miscellaneous concrete construction and removal.

Removing concrete shall conform to the provisions in Section 15, "Existing Highway Facilities," of these Standard Specifications and the Special Provisions.

Concrete removed shall be disposed of in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State of California Standard Specifications.

Where no joint exists between concrete to be removed and concrete to remain in place, the concrete shall be cut in a neat line to a minimum depth of seventeen-hundredths of one foot (0.17') with a power-driven saw before concrete is removed. Curb, gutter, and sidewalk shall conform to the provisions in Section 73, "Concrete Curbs and Sidewalks," of the State of California Standard Specifications. Replacement of sidewalk and wheelchair ramps shall be considered as included in the contract price.

21.05 STANDARDS, STEEL PEDESTALS, AND POSTS

Section 86-2.04, "Standards, Steel Pedestals, and Posts," of the State of California Standard Specifications is amended by adding the following after paragraph eleven:

> *All galvanized nuts used on assemblies with a specific pre-load or torque shall be lubricated in accordance with the requirements specified for galvanized Grade DH nuts in ASTM Designation: A563.*

The sign-mounting hardware shall be installed at the locations shown in the approved Construction Drawings. The sign panels shall be furnished by the Contractor. Where the approved Construction Drawings refer to the side tenon detail at the end of the signal mast arm, the applicable tip tenon detail may be substituted.

21.06 CONDUIT

All conduit shall be rigid metal type.

When a standard coupling cannot be used for coupling metal type conduit, a UL-Iisted threaded union coupling, as specified in the third paragraph in Section 86-2.05C "Installation" of the State of California Standard Specifications, or a concrete-tight split coupling or concrete-tight set screw coupling shall be used.

Conduit shall be installed by jacking or drilling in accordance with Section 86-2.05C "Installation" of the State of California Standard Specifications. Installation of conduit by the trenching method will only be permitted when requested by the Contractor, in writing, and approved by the Engineer. When used, the trenching method shall be as provided below.

Conduit runs shown in the approved Construction Drawings to be located behind curbs may be installed in the street, within three feet (3') of and parallel to the gutter line of the curb, by trenching as provided below. All pull boxes shall be located behind the curb or at the location shown in the approved Construction Drawings.

After conductors have been installed, the ends of conduits terminating in pull boxes and in service and controller cabinets shall be sealed with an approved type of sealing compound.

At locations where conduit is to be installed by jacking or drilling as provided in Section 86-2.05C "Installation" of the State of California Standard Specifications, and if delay to any vehicle will not exceed five (5) minutes, conduit may be installed by the trenching method as follows:

a. Trenching Installation of Conduit: Conduit shall be placed under existing pavement in a trench approximately two inches (2") wider than the outside diameter of the conduit to be installed. Trench shall not exceed six inches (6") in width. Conduit depth shall not be less than eighteen inches (18") in depth, except that at pull boxes the trench may be hand dug to required depth. The outline of all areas of pavement to be removed shall be cut to a minimum depth of three inches (3") with a rock-cutting excavator specifically designed for this purpose. Cuts shall be neat and true with no shatter outside the removal area. The conduit shall be placed in the bottom of the trench, and the trench shall be backfilled with a two-sack slurry cement, conforming to two appropriate portions of Section 19-3.062 of the State of California Standard Specifications. The top of slurry mix shall be two inches (2") below A.C. Pavement, after slurry mix has set-up, the trench shall be patched with one-half of one inch (½") mix asphalt concrete.

   Prior to spreading asphalt concrete, paint binder shall be applied as specified in Section 39-4.02, "Prime Coat and Paint Binder" of the State of California Standard Specifications. Spreading and compacting of asphalt concrete shall be performed by any method that will produce an asphalt concrete surfacing of uniform smoothness, texture, and density.

   All excavated areas in the pavement shall be backfilled, except for the top two inches (2"), by the end of each work period.

21.07 PULL BOXES

Grout shall be placed in bottom of pull boxes.

21.08 CONDUCTORS AND WIRING

Splices shall be insulated by "Method B."

21.09 SIGNAL CABLE

Where shown in the approved Construction Drawings, signal cable shall be installed in lieu of individual conductors.

Signal cable shall conform to the following:

a. The cable jacket shall be black polyethylene with an inner polyester binder sheath and shall be rated for 600 volts and seventy-five degrees Fahrenheit (75° F). All

cables shall have clear, distinctive, and permanent markings on the outer surface throughout the entire length of the cable showing the manufacturer's name or trademark, insulation designation, number of conductors, conductor sizes, and the voltage rating of the jacket. Filler material, if used, shall be polyethylene material.

b. Individual conductors in the cable shall be solid copper with Type THWN insulation and shall conform to the requirements in Section 86-2.08, "Conductors" of the State of California Standard Specifications and ASTM Designation: 8286. The minimum thickness of Type THWN insulation, at any point, shall be thirteen millimeters (13 mils) for conductor sizes No. 14 and No. 12, and eighteen millimeters (18 mils) for conductor size No. 10. The minimum thickness of the nylon jacket shall be four millimeters (4 mils) at any point.

c. Each signal cable shall be marked in each pull box showing the signal standard to which it is connected.

21.10 SERVICE

The new service shall conform to the following:

a. The service equipment enclosure shall be fabricated from aluminum as per Section 86-2.11 of the State of California Standard Specifications. The cabinet door shall have a two thousand pound (2,000 lb.) stress rated aluminum hasp, welded to the cabinet door.

b. Service cabinets, conduits, and pull boxes shall not be installed until the service locations have been verified by the servicing utility.

c. It shall be the Contractor's responsibility to verify the location of and make arrangements for and to pay for all costs to provide the necessary connection for the traffic signal and safety lighting service.

d. The Contractor shall install all necessary service cabinets, conduits and pull boxes to provide electrical service as the first item of construction. AFTER SERVICE HAS BEEN INSPECTED AND TAGGED BY THE CITY, the Contractor shall, within forty-eight (48) hours, request electrical service from Southern California Edison Company by phone and letter. A copy of the letter shall be sent to the Engineer.

21.11 FUNCTIONAL TESTING

The functional test for each lighting system shall consist of not less than fourteen (14) days. If unsatisfactory performance of the system develops, the conditions shall be corrected and the test shall be repeated until the fourteen (14) days of continuous, satisfactory operation is obtained.

21.12 PAINTING

All exposed metal signal sections, signal head mountings, brackets and fittings, doors, visors, backplates, pedestrian push-button housings, and pedestrian signal sections shall be powder coated by a City-approved process, in lieu of painting.

The minimum requirements are as follows:

a. A 3-5 stage pretreatment consisting of:

   i. Degrease

   ii. Rinse

   iii. Iron Phosphate

   iv. Rinse

   v. Seal

   Note: Items "i" and "iii" can be combined thereby eliminating item "c", making this a three-stage process.

b. A dry-off cycle for at least ten (10) minutes at three hundred degrees Fahrenheit (300° F) to four hundred degrees Fahrenheit (400° F).

c. Electrostatically applied powder at 75-90KV.

d. Thermal setting cycle for twenty (20) minutes at four hundred degrees Fahrenheit (400° F).

All parts shall be coated with an ultraviolet-resistant polyester powder. The only exception is for items of flat black that can be coated with a self-cleaning flat black epoxy .

Contractor shall furnish manufacturer's "Certificate of Compliance" with City-approved powder coating process prior to installation of equipment.

21.13 MODEL 170E CONTROLLER ASSEMBLIES

Model 170E controller assembly or assemblies shall be furnished by the Contractor. Controllers shall be tested and certified in accordance with Section 86-3, "Controller Assemblies" of the State of California Standard Specifications and shall be warranted for a period of one (1) year from date of "turn-on."

In addition to the provisions in Section 86-3.03, "Model 170 and Model 270 Controller Assemblies" of the State of California Standard Specifications, the complete control system, including the Model 332 cabinet, shall conform to the State of California Standard Specifications, "Traffic Signal Control Equipment Specifications" and any subsequent addenda.

The above-referenced document is available from State of California, Bids and Documents Section, in Sacramento for a fee.

The controller cabinet shall be fabricated from aluminum as specified in Section 86-3.07A of the State of California Standard Specifications.

The controller assembly shall include a pull-out shelf with internal document storage compartment mounted below the 170E controller position.

Conflict monitor shall be Model 210-P.

The Contractor shall supply the Model 170E controller. The controller unit shall be furnished complete with a Model 412C PROM module configured for Method No. 2, Memory Select No. 4. A full complement of EPROM chips shall be furnished for the controller program module. The software program will be furnished by the City. Two (2) complete manuals and four (4) complete cabinet wiring diagrams shall be supplied in accordance with the above-referenced Specifications and any subsequent addenda.

The Contractor shall provide extra equipment to the City as follows:

a. One (1) extra Model 170E controller.

The Contractor shall furnish and install all other components necessary for proper operation of the traffic signal system, including but not limited to, power supply, switch packs, and loop detector amplifiers.

The signal controller shall include a standard communications protocol which meets or exceeds the requirements of AB 3418 as specified by Caltrans. This protocol shall be selectable by the user as an alternative to the normal protocol when communications with a master supporting the AB 3418 protocol is desired. The AB 3418 protocol in the controller shall not substitute for or alter the operation of the normal communications protocol without the written approval of the Engineer. The normal communications protocol shall be the default protocol enabled on controller start up. Contractor shall certify, in writing, that the controller software complies with -AB 3418.

The protocol shall include support for uploading system detector data using the optional message defined for that purpose.

The Contractor shall arrange to have a Signal Technician, qualified to work on the control equipment and employed by the control equipment manufacturer or his representative, present at the time the equipment is turned on.

21.14 MODULATED LIGHT SIGNAL DETECTION SYSTEM

a. A Tomar 2000 Series, or better, emergency vehicle pre-emption system shall be installed. The system shall include four (4) detectors mounted on traffic signal mast arms, cable, and any other necessary hardware and/or software to operate the system. The cabinet shall include two (2), 2-channel emergency vehicle pre-emption phase selectors (discriminators) per these technical specifications.

b. The modulated light signal detection system shall conform to the Special Provisions.

c. The modulated light signal detection system shall be a Tomar 2000 Series, or approved equal. Cable shall not be spliced between controller and detector and shall be Model 138 or approved equal.

d. Detectors shall be mounted on traffic signal mast arms and shall be centered over the number one lane.

e. The Contractor shall provide extra equipment to the City as follows:

   i. One (1) extra optical detector head.

f. System Operation—The Contractor shall demonstrate that all of the components of each system are compatible and will perform satisfactorily as a system. Satisfactory performance shall be determined using the following test procedure:

   i. Each system to be used for testing shall consist of an optical emitter assembly, an optical detector, at least two hundred feet (200') of optical detector cable, and a phase selector (discriminator) module.

   ii. The phase selector (discriminator) modules shall be properly installed in the cabinet.

   iii. Two (2) tests shall be conducted; one using a Class I signal emitter and a distance of one thousand feet (1,000') between the emitter and the detector, the other using a Class II signal emitter and a distance of one thousand eight hundred feet (1,800') between the emitter and the detector. All range adjustments on the module shall be set to "Maximum" for each test.

   iv. Each above test shall be conducted for a period of one (1) hour, during which the emitter shall be operated for thirty (30) cycles, each consisting of a one (1) minute "on" interval and a one minute "off" interval. During the total test period,

      (a) The emitter signal shall cause the proper responses from the controller unit during each "on" interval

      (b) There shall be no improper operation of either the controller unit or the conflict monitor during each "off" interval.

g. Certificates and Warranties – Manufacturers' certificates and warranties shall be presented to the City inspector before traffic signal turn-on.

21.15 VEHICLE SIGNAL FACES AND SIGNAL HEADS

Signal faces, signal heads, and auxiliary equipment as shown in the approved Construction Drawings, and the installation thereof, shall conform to the provisions in Sections 86-4.01

"Vehicle Signal Faces", 86-4.03 "Backplates", and 86-4.06 "Signal Mounting Assemblies" of the State of California Standard Specifications and these Standard Specifications.

All green and yellow sections shall be provided with a Light Emitting Diode Kit that conforms to Section 22.16 of these Standard Specifications. All red sections shall be provided with a Light Emitting Diode Kit that conforms to Section 22.17 of these Standard Specifications.

Visors on vehicular signals shall be "tunnel" type with open slot at bottom.

All signal heads, housings, directional louvers, visors, and backplates shall be metallic. All vehicle signal lenses shall be twelve inches (12") in diameter.

21.16 LIGHT EMITTING DIODE GREEN AND YELLOW MODULE

All twelve inch (12") green and yellow circular sections and twelve inch (12") green and yellow arrow sections shall be provided with Type 1 LED Traffic Signal Modules.

All devices must meet the general specifications of the Transportation Electrical Equipment Specifications (TEES), Chapter 1--General Specifications, as well as these Standard Specifications. In case of conflict, these Standard Specification shall govern over the TEES, Chapter 1 Electrical Power Consumption.

Maximum power consumption requirements are as follows:

GREEN LEDs:

Temperature	77° F	166° F
12" circular	12.0 W	12.0 W
12" arrow	13.0 W	13.0 W

YELLOW LEDs:

Temperature	77° F	166° F
12" circular	22.0 W	25.0 W
12" arrow	10.0 W	12.0 W

b. Operation Voltage: The modules shall operate from a 60 HZ, ±3 HZ AC, line over a voltage ranging from 95 volts to 135 volts. The fluctuations of line voltage shall have no visible effect on the luminous intensity of the indications.

   Operating voltage of the modules shall be 120 VAC. All parameters shall measured at this voltage.

c. Power Factor: The LED signal module shall have a power factor of nine-tenths (0.90) or greater.

d. Total Harmonic Distortion (THD): Total harmonic distortion (current and voltage) induced into an AC power line by a LED signal module shall not exceed twenty percent (20%).

e. Surge Suppression: The signal module onboard circuitry shall include voltage surge protection to withstand high repetition noise transients as stated in Section 2.1.6 of NEMA Standard TS-2, 1992.

The LED circuitry shall prevent perceptible flicker to the unaided eye over the voltage range specified above.

All wiring and terminal blocks shall meet the requirements of Section 13.02, "Equipment and Material Standards" of the ITE Publication.

The modules shall be operationally compatible with currently used controller assemblies (solid state load switches, flashers, and conflict monitors). Review TEES Chapters 3 and 6 for specifications on these devices.

The modules and associated on-board circuitry must meet Federal Communications Commission (FCC) Title 47, SubPart B, Section 15 regulations concerning the emission of electronic noise.

f. Photometric Requirements: The minimum initial luminous intensity values for the modules shall be as defined in VTCSH Part 2, Section 4.1 at seventy-seven degrees Fahrenheit (77° F).

The modules shall meet or exceed eighty-five percent (85%) of the standard light output values found in the ITE publication: Equipment and Material Standards, VTCSH Part 2, throughout the useful life based on normal use in a traffic signal operation over the operating temperature range.

The measured chromaticity coordinates of the modules shall conform to the chromaticity requirements of VTCSH Part 2, Section 4.2, throughout the useful life over the operating temperature range.

g. Physical and Mechanical Requirements: LED traffic signal modules shall be designed as retrofit replacements for existing optical units of signal indications and shall not require special tools for installation. Type 1 modules shall be installed.

h. Environmental Requirements: The LED signal module shall be rated for use in the operating temperature range of minus forty degrees Fahrenheit (-40°F, or -40°C) to one hundred sixty-five degrees Fahrenheit (165° F, or 74°C). The modules shall meet all specifications throughout this range.

The LED signal module shall be protected against dust and moisture intrusion per the requirements of NEMA Standard 250-1991 for Type 4 enclosures to protect all internal components.

i. Construction: The LED signal module shall be a single, self-contained device, not requiring on-site assembly for installation into an existing traffic signal housing. The power supply for the module shall be integral to the unit.

The circuit board and power supply shall be contained inside the module. Circuit boards shall conform to Chapter 1, Section 6 of the "Transportation Electrical Equipment Specifications".

The assembly and manufacturing process for the LED signal assembly shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

j. Materials: Material used for the lens and signal module construction shall conform to ASTM Specifications for the materials.

Enclosures containing either the power supply or electronic components of the signal module shall be made of UL94VO flame retardant materials. The lens of the signal module is excluded from this requirement.

k. Module Identification: Each module shall have:

i. Manufacturer's name,

ii. Trademark,

iii. Model number,

iv. Serial number,

v. Date of manufacture (month-year), and

vi. Lot number as identification permanently marked on the back of the module.

The following operating characteristics shall be permanently marked on the back of the module: rated voltage and rated power in Watts and Volt-Ampere.

If a specific mounting orientation is required, each module shall have prominent and permanent marking(s) for correct indexing and orientation within a signal housing. The markings shall consist of an up arrow, or the word "UP" or "TOP".

l. Type 1 Traffic Signal Module: The following specification requirements apply to the Type 1 module only. All general specifications apply unless specifically superceded in this section.

Type 1 modules can be manufactured under this specification for the following faces:

i. Twelve inch (12") green circular

ii. Twelve inch (12") green arrow

m. Physical and Mechanical Requirements: The module shall fit into existing traffic signal section housings built to the specifications detailed in ITE Publication: Equipment and Material Standards, "Vehicle Traffic Control Signal Heads", with

the reflector and lamp socket remaining in place, and without modification to the housing.

Each Type 1 module shall be designed to be installed in the door frame of a standard traffic signal housing. The Type 1 module shall be sealed in the door frame with a one-piece EPDM (ethylene propylene rubber) gasket.

The maximum weight of a Type 1 module shall be one and eight tenths kilograms (1.8kg, or four pounds).

n. Construction: Each Type 1 module shall be a sealed unit to include all parts necessary for operation (a printed circuit board, power supply, a green lens and gasket, etc.), and shall be weather proof after installation and connection.

o. Conductors: Two (2) secured, color coded, nine hundred fourteen millimeter (914 mm, or thirty-six inch) long, 600 V, twenty gauge (#20) minimum, jacketed wires, conforming to the National Electric Code, rated for service greater than two hundred twenty degrees Fahrenheit (220° F), are to be provided for electrical connection for each Type 1 LED signal module. Conductors for Type 1 modules shall be one meter (1m) in length, with quick disconnect terminals attached and shall conform to Section 86-4.01C, "Electrical Components" of the State of California Standard Specifications.

If specified in the purchased order, the module will be equipped with an adapter that will screw into the medium base, lamp socket. The adapter shall be able to accept the quick disconnect terminals at the end of the conductors for the module. The electrical contacts of the adapter shall be made of brass.

p. Lens: The lens of the Type 1 module shall be integral to the unit, shall be convex with a smooth outer surface and made of plastic or of glass.

The lens may be tinted or may use transparent film or materials with similar characteristics to enhance ON/OFF contrasts.

The use of tinting or other materials to enhance ON/OFF contrasts shall not affect chromaticity and shall be uniform across the face of the lens.

The LED signal module lens shall be UV stabilized and shall be capable of withstanding ultraviolet (direct sunlight) exposure for a minimum period of forty-eight (48) months without exhibiting evidence of deterioration. If a polymeric lens is used, a surface coating or chemical surface treatment shall be used to provide front surface abrasion resistance.

q. 12" Arrow: The following specification requirements apply to the twelve inch (12") arrow module only. All general specifications apply unless specifically superseded in this Section.

   i. The arrow module shall meet specifications stated in the VTCSH Section 9.00 for arrow lenses.

ii. The LEDs shall be spread evenly across the illuminated portion of the arrow area.

iii. Each module shall provide an average luminous intensity of at least five thousand five hundred candela per square meter (5,500 cd/m^2) throughout the useful life over the operating temperature range. Arrow modules shall be tested as per California Test 3001.

r. Quality Assurance:

The modules shall be manufactured in accordance with a manufacturer quality assurance (QA) program. The QA program shall include two (2) types of Quality Assurance:

i. Design quality assurance

ii. Production quality assurance. The production quality assurance shall include statistically controlled routine tests to ensure minimum performance levels of The modules built to meet this specification, and a documented process of how problems are to be resolved.

QA process and test results documentation shall be kept on file for a minimum period of seven (7) years.

LED signal module designs not satisfying design qualification testing and the production quality assurance testing performance requirements described below shall not be labeled, advertised, or sold as conforming to this specification.

s. Production Quality Control Testing: The following Production Quality Assurance tests shall be performed on each new module prior to shipment. Failure to meet requirements of any of these tests shall be cause for rejection. Test results shall be retained by the manufacturer for seven (7) years.

i. Burn-in period shall consist of each signal module being energized at rated voltage for a thirty (30) minute stabilization period before the measurement is made.

ii. Each module shall be tested for rated initial intensity after burn-in.

iii. A single point measurement, with a correlation to the intensity requirements of Section 1.04 of the VTCSH for circular modules, may be used.

iv. The ambient temperature for this measurement shall be greater than seventy-seven degrees Fahrenheit (77° F). Each module not meeting minimum luminous intensity requirements per Table 1 of VTCSH for circular modules, eleven thousand candela per square meter (11,000 cd/m^2) for arrow modules, or three thousand seven hundred fifty candela per square meter (3,750 cd/m^2) for pedestrian modules shall be cause for rejection.

v. Each module shall be tested for required power factor after burn-in.

vi. Each module shall be measured for current flow in amperes after burn-in. The measured current values shall be compared against rated values resulting from design qualification measurements. The current flow shall not exceed the rated value.

vii. Each module shall be visually inspected for any exterior physical damage or assembly anomalies. Careful attention shall be paid to the surface of the lens to ensure there are no scratches (abrasions), cracks, chips, discoloration, or other defects. Any such defect shall be cause for rejection.

t. Warranty:

The manufacturer shall provide a written warranty against defects in materials and workmanship for the modules for a period of sixty (60) months after acceptance of the modules. Replacement modules shall be provided promptly after receipt of modules that have failed at no cost to the City. All warranty documentation shall be given to the City prior to random sample testing.

21.17 LIGHT EMITTING DIODE KIT RED MODULE

All signal sections and pedestrian signals shall be provided with a Light Emitting Diode (LED) Kit. The LED kit shall replace the reflector, socket, gasket, and lens assembly of the incandescent signal face as specified in Section 86-4.05 "Vehicle Signal Faces" of the State of California Standard Specifications. Each retrofit unit shall consist of a convex smooth red polycarbonate ultraviolet stabilized lens, LED circuit board, constant current type power supply, a molded rear housing and EPDM gasket for retaining the assembly in the door of the signal section. The installed unit shall be watertight.

The LEDs shall utilize AllnGaP technology and shall be the ultra bright type rated for a minimum of one-hundred thousand (100,000) hours of continuous operation (nominal current and seventy-seven degrees Fahrenheit). The minimum operation range of the unit shall be from seventy-seven degrees Fahrenheit (77º F) to one hundred fifty-eight degrees Fahrenheit (158º F). The LED emission spectrum shall be six hundred sixty nanometers (660 nm) nominal. The viewing angle of the mounted unit shall not be less than thirty degrees (30°).

The Led signal module shall provide a power factor of nine tenths (0.90) or better.

Total harmonic distortion (current and voltage) induced into an AC power line by a LED signal module shall not exceed twenty percent (20%).

The operating voltage range of the unit shall be between 92 VAC and 125 VAC. Fluctuations of line voltage shall have a minimal effect on the luminous intensity of the indication. The units shall be compatible with Conflict Monitors utilizing Red Monitoring without the installation of any external components. The burnout of any single LED shall not result in the loss of the entire indication.

Nominal power consumption of a twelve inch (12") ball indication shall be less than thirty watts (30w). Nominal power consumption of a twelve inch (12") arrow indication shall be less than twenty watts (20w).

The rated luminous output of each LED and the number of LEDs installed in each unit shall be sufficient to meet or exceed the most recent ITE specifications. A "Statement of Compliance" from a third party testing facility shall be supplied to the City.

For twelve inch (12") ball indications, the minimum number of LEDs shall be six hundred (600). For the twelve inch (12") arrow indications, the minimum number of LEDs shall be two hundred fifty (250). Units utilizing an optical component may have fewer LEDs. The LEDs shall be spaced in a uniform pattern throughout the indication.

a. Certificate of Compliance: The Contractor shall provide the Engineer with a "Certificate of Compliance" from the manufacturer in accordance with the provisions of Section 6.03 "Certificates of Compliance" of these Standard Specifications. The certificate shall certify that the LED signal modules comply with the requirements of these Standard Specifications. The certificate shall also include a copy of applicable test reports on the LED signal modules.

b. Warranty: The manufacturer shall provide a written warranty against defects in materials and workmanship for the LED signal modules for a period of sixty (60) months after installation of the modules. Replacement modules shall be provided promptly after receipt of modules that have failed at no cost to the City of Visalia except cost of shipping of the failed modules. Warranty documentation shall be given to the Engineer prior to installation.

21.18 PEDESTRIAN SIGNALS

a. Pedestrian signals shall be Type C, except that solid-state controllers shall be used in lieu of transformers.

b. Both the "Upraised Hand" and "Walking Person" shall use light emitting diode (LED) as the light source in lieu of an incandescent lamp for use in pedestrian signal faces.

c. The installation shall not require any special tools or the drilling of any holes in the reflector or housing.

d. The luminous intensity, quantity and color of the LEDs shall be such that the intent of the current ITE specification for Pedestrian Traffic Control Signal Indications is satisfied.

e. The unit shall have a maximum power consumption of fifteen watts (15w) at 120 VAC. The unit shall operate between 92 VAC and 125 VAC and from seventy-seven degrees Fahrenheit (77º F) to one hundred fifty-eight degrees Fahrenheit (158º F).

f. Each assembly shall consist of a minimum of two hundred twenty-five (225) LEDs arranged in minimum of 3 strings. The loss of a single LED shall result in a loss of only that string.

g. LED pedestrian signal face "Upraised Hand & Walking Person" module shall be designed to mount in the standard existing Type A housing. Pedestrian signal face modules shall be designed to mount behind or replace the existing face plate of existing Type A housing as specified by the requirements of the ITE Standards "Pedestrian Traffic Control Signal Indications" and the MUTCD. The design of the modules shall require a specific mounting orientation.

21.19 DETECTORS

a. Vehicle detectors shall be Type E as indicated in the approved Construction Drawings, and shall conform to the applicable provisions of Section 86-5 "Detectors" of the State of California Standard Specifications. Loops shall be cut into pavement and installed on the same day. This shall include placement of loops and asphaltic concrete sealant.

b. Loop wire shall be Type 1.

c. Loop detector lead-in cable shall be Type C.

d. The sides of the slot shall be vertical, and the minimum radius of the slot entering and leaving the circular part of the loop shall be one and one-half inches (1½"). Slots in asphalt concrete pavement shall be filled with asphaltic concrete sealant as follows:

   i. After conductors are installed in the slots cut in the pavement, paint binder shall be applied to all vertical surfaces of slots in accordance with the provisions in Section 39-4.02, "Prime Coat and Paint Binder" of the State of California Standard Specifications.

   ii. Temperature of sealant material during installation shall be above seventy degrees Fahrenheit (70° F). Air temperature during installation shall be above fifty degrees Fahrenheit (50° F). Sealant placed in the slots shall be compacted by use of an eight inch (8") diameter by one-eighth of one inch (⅛") thick steel hand roller or other tool approved by the Engineer. Compacted sealant shall be flush with the pavement surface. Minimum conductor coverage shall be one inch (1"). Excess sealant remaining after rolling shall not be reused. On completion of rolling, traffic will be permitted to travel over the sealant.

e. Conductors for each inductive loop detector shall be continuous and unspliced from the pull box adjacent to the loop to the field terminals in the cabinet.

21.20 PEDESTRIAN PUSH BUTTONS

Pedestrian push-button assemblies shall comply with the Architectural and Transportation Barriers Compliance Board Interim Final Ruling on the Americans with Disabilities Act Accessibility Guidelines and the following requirements:

a. The housing for the unit shall be made of 356 Aluminum heat treated to meet Specificaion T-6. It shall be of a telescoping, vandal-proof design. The color shall be black matching color #17038, #27038, or #37038 of Federal Standard #595B.

b. The plunger/actuator surface shall have a diameter of two inches (2") or greater. It shall be made of polished stainless steel and assembled with all stainless steel components so as not to be corrosive. The actuator shall be conical in shape with the cone extending four hundred four thousandths of one inch (.404") above the bezel of the switch housing in the neutral position.

c. The microswitch component shall be a dust-proof, water-resistant type. It shall be a single-pole, precision, snap-acting type. It shall also be UL listed and CSA Certified and meet the requirements for NEMA TS-1 and TS-2.

d. The complete switching unit shall have an operating force of three pounds (3 lbs.) and a minimum release force of three pounds (3 lbs.). Pre-travel shall be sixty-two thousandths of one inch (0.062") minimum. Over-travel shall be sixty-two thousandths of one inch (0.062") minimum.

e. Units shall permit recessed mounting in existing standard type pedestrian push-button assemblies without modification.

21.21 SAFETY AND STREET LIGHTING

a. Luminaires used for safety shall be GE #M2AC (200 Watt) S7HGMC31 or equal. A twist-Iock photo-electrical control unit and receptacle shall be installed on each luminaire.

b. All luminaires to be mounted on horizontal mast arms, when tested in accordance with California Test 611, shall be capable of withstanding cyclic loading in:

   i. A vertical plane at a minimum peak acceleration level of 3.0 g's peak-to-peak sinusoidal loading (same as 1.5 g's peak) with the internal ballast removed for a minimum of two million cycles without failure of any luminaire parts, and

   ii. A horizontal plane perpendicular to the direction of the mast arm at a minimum peak acceleration level of 1.5 g's peak-to-peak sinusoidal loading (same as 0.75 g's peak) with the internal ballast installed for a minimum of two million cycles without failure of any luminaire parts.

c. No part of the slipfitter mounting brackets on the luminaires shall develop a permanent set in excess of two hundredths of one inch (0.02") when the four (4) three-eighths of one inch (⅜") diameter cap screws used for mounting are tightened to a torque of ten foot pounds (10 ft lbs).

d. Ballasts shall be the lag regulator type.

e. Each light shall have a fuse protection located in the pull box next to the lighting standard.

21.22 REMOVING, REINSTALLING, OR SALVAGING ELECTRICAL EQUIPMENT

Salvaged traffic signal equipment and electrical materials shall be hauled to City of Visalia Corporation Yard and stockpiled, unless noted otherwise in the approved Construction Drawings.

21.23 TRAFFIC SIGNAL STREET NAME SIGNS

The Contractor shall furnish and install Traffic Signal Street Name Signs and sign mounting brackets as shown in the approved Construction Drawings or per the City of Visalia Engineering Improvement Standards and described below. The signs and sign mounting brackets shall be manufactured in accordance with the specifications, drawings, and lists detailing information.

a. Reflective Materials: Sheeting material, letters, and border materials shall be Diamond Grade LDP (long distance performance) manufactured by 3M Co. NO SUBSTITUTES will be permitted.

   All letters and border material shall be white in color similar to 3M Co. #3970. Background color shall be green similar to 3M Co. #3977. Only die-cut material shall be used for the letters and border material. No silk-screening of signs will be allowed.

   Spacing of all letters shall be in accordance with sheeting manufacturer's recommended standard so as to achieve optimum legibility and uniformity under both day and night conditions.

b. Blade Structure: All aluminum sign blanks shall be 6061-T6 Alloy or 5052H38, eight-hundredths of one inch (0.080") in thickness.

   Dimensions of sign blanks shall be forty-eight inches (48") minimum to eighty-four inches (84") maximum wide by eighteen inches (18") high. No splices of sign blanks shall be permitted.

   Each sign shall have a one and one-fourth inches by one and one-forth inches by one-eighth of one inch (1¼"x1¼"x⅛") aluminum angle as stiffeners. One near the top and one near the bottom of the sign. Space between the stiffeners shall be fifteen and three-fourths inches (15¾") outside to outside and centered on the sign. Stiffeners shall be fastened to the sign, with legs of aluminum angle pointing toward the center of the sign, using three-sixteenths of one inch ($^{3}/_{16}$") rivets placed on six inch (6") centers. No rivet shall be placed closer than one inch (1") nor more than two inches (2") from the edge of the sign. All stiffeners shall be equal in length to the sign. Stiffeners shall be installed after face material has been applied to the aluminum sign blank.

   Each stiffener shall have two (2) three-eighths of one inch (⅜") diameter holes spaced four and seven-eighths inches (4⅞") apart. The holes shall be centered on a point one-third (⅓) of the way from the right-hand edge of the sign when facing the legend. Holes shall match those in the sign mounting bracket.

c. Sign Mounting Bracket: Material used to manufacture sign bracket shall be twelve gallons (12gal), hot-rolled sheet steel, low carbon, commercial quality, specification QQS-663, grade 1010. Bracket shall be hot-dip galvanized after fabrication per specification ASTM-A-123_68.

Tolerances shall be plus or minus one thirty-seconds of one inch ($^{1}/_{32}$"), for angles plus or minus zero degrees to thirty minutes (±0d30'00").

Four (4) five-sixteenths of one inch (5/16") – thirteen inches by one and one-half inche (13"x1½") bolts with proper nuts and one (1) lock washer per bolt shall be provided as part of the sign mounting bracket.

d. Quality of Work: All signs fabricated shall conform to the manufacturer of sheeting, letters, and borders application methods. All signs shall be free of wrinkles, cracking, crazing, or blistering upon delivery to the City.

Satisfactory performance of reflective quality of fabricated signs shall be as follows:

i. Minimum Initial Retroreflectivity Brightness
ii. Candelas per foot candle per square foot
iii. (0.2 deg obs. and -4 deg entrance)

Color	M.I.R.B.
White	800
Green	80

The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that:

i. The sign is ineffective for its intended purpose when viewed from a moving motor vehicle under normal day and night driving conditions; or

ii. The coefficient of retroreflection is less than the minimum specified.

All signs shall be date stamped, at the time of fabrication as per manufacturer's requirements to verify guarantee period. Any sign not so marked shall be replaced at the manufacturer's expense.

Traffic signal street name signs shall be strapped to the signal poles at a height of sixteen feet (16') to the bottom of the sign by the use of three-fourths of one inch (¾") wide, three-tenths of one inch (0.030") thick, AISI Type 201 stainless steel strapping. Strapping shall be placed at the three (3) locations provided by the slots in the mounting bracket. Buckles used shall be designed for three-tenths of one inch (0.030") stainless steel banding. City will supply street name sign and mounting bracket. Contractor is to provide strapping and strapping hardware.

21.24 TRAFFIC SIGNAL BATTERY BACK-UP SYSTEM

a. General: This specification establishes the minimum requirements for a complete emergency battery backup system for use with Light Emitting Diode (LED) Traffic Signal Modules. The battery backup system (BBS) shall include, but not be limited to the following:

   i. Inverter/charger,

   ii. Power transfer relay,

   iii. Batteries,

   iv. A separate manually operated non-electronic bypass switch and

   v. All necessary hardware and interconnect wiring.

   The BBS shall provide reliable emergency power to a traffic signal system (Vehicle and Pedestrian Traffic) in the event of a power failure or interruption.

   The BBS shall be capable of providing power for full run-time operation for an "LED-only" intersection (all colors: red, yellow, green and pedestrian heads) or flashing mode operation for an intersection using Red LED's.

   The BBS shall be designed for outdoor applications, in accordance with the Caltrans Transportation Electrical Equipment Specifications (TEES), Chapter 1, Section 8 Requirements.

b. Operation: The BBS shall provide a minimum two (2) hours of full run-time operation for an "LED-only" intersection (minimum 700W/1000VA active output capacity, with eighty percent (80%) minimum inverter efficiency).

   The maximum transfer time allowed, from disruption of normal utility line voltage to stabilized inverter line voltage from batteries, shall be sixty-five milliseconds (65ms). The same maximum allowable transfer time shall also apply when switching from inverter line voltage to utility line voltage.

   The BBS shall provide the user with three (3) sets of normally open (NO) and normally closed (NC) single-pole double-throw (SPDT) dry relay contact closures, available on a panel-mounted terminal block, rated at a minimum 120V/1A, and labeled so as to identify each contact. For typical configuration, see Figure 3(b).

   i. The first set of NO and NC contact closures shall be energized whenever the unit switches to battery power. Contact shall be labeled or marked "On Batt."

   ii. The second set of NO and NC contact closures shall be energized whenever the battery approaches approximately forty percent (40%) of remaining useful capacity. Contact shall be labeled or marked "Low Batt."

iii. The third set of NO and NC contact closures shall be energized two hours after the unit switches to battery power. Contact shall be labeled or marked "Timer"

Operating temperature for both the inverter/charger, power transfer relay and manual bypass switch shall be minus thirty-five degrees Fahrenheit (-35° F) to one hundred sixty-six degrees Fahrenheit (166° F).

Both the Power Transfer Relay and Manual Bypass Switch shall be rated at 240VAC/30 amps, minimum.

The BBS shall use a temperature-compensated battery charging system. The charging system shall compensate over a range of 2.5 - 4.0 mV/°C per cell.

The temperature sensor shall be external to the inverter/charger unit. The temperature sensor shall come with two meters (2m, or six feet six inches) of wire.

Batteries shall not be recharged when battery temperature exceeds one hundred twenty-two degrees Fahrenheit, plus or minus thirty-eight degrees (122° F ± 38°).

BBS shall bypass the utility line power whenever the utility line voltage is outside of the following voltage range: 100VAC to 130VAC (± 2VAC).

When utilizing battery power, the BBS output voltage shall be between 110 VAC and 125 VAC, pure sine wave output, three percent (3%) THD, 60Hz ± 3Hz.

BBS shall be compatible with Caltrans Model 332 Cabinets, Model 170 Controllers, Model 2070 Controllers and cabinet components for full time operation.

When the utility line power has been restored at above 105 VAC ± 2 VAC for more than thirty (30) seconds, the BBS shall transfer from battery backed inverter mode back to utility line mode.

BBS shall be equipped to prevent a malfunction feedback to the cabinet or from feeding back to the utility service.

In the event of inverter/charger failure, battery failure or complete battery discharge, the power transfer relay shall revert to the NC (and de-energized) state, where utility line power is connected to the cabinet.

Recharge time for the battery, from "protective low-cutoff" to eighty percent (80%) or more of full battery charge capacity, shall not exceed twenty (20) hours.

c. Mounting / Configuration

i. General: Inverter/Charger Unit shall be rack or shelf-mounted.

Power Transfer Relay and Manual Bypass Switch shall be mounted on the 332 Cabinet standard Electronic Industries Association (EIA) rail.

All interconnect wiring provided between Power Transfer Relay, Bypass Switch and Cabinet Terminal Service Block shall be no less than two meters (2m, or six feet six inches) of ten gauge (#10) wire.

Relay contact wiring provided for each set of NO/NC relay contact closure terminals shall be two meters (2m, or six feet six inches) of eighteen gauge (#18) wire.

See Figure 4 that provides clarification as to how BBS Power Transfer Relay and Manual Bypass Switch are interconnected with Model 332A Cabinets in order to ensure interchangeability between all BBS manufacturers.

All necessary hardware for mounting (shelf angles, rack, etc) shall be included in the bid price of the BBS. A minimum of six (6) bolts/fasteners shall be used to secure swing-trays to the 332 Cabinet Standard EIA four hundred eighty two and six-tenths millimeters (482.6mm, or 19") rack. All bolts/fasteners and washers shall meet the following requirements:

(a) Screw type: Pan Head Phillips machine screw,

(b) Size and Thread pitch: 10-32,

(c) Material: 18-8 stainless steel (Type 316 stainless steel is acceptable as an alternate),

(d) Washer: Use one (1) flat washer (18-8 stainless steel) under the head of each 10-32 screw (provided that the screws are properly tightened, lock washers are unnecessary),

(e) Number of screws per swivel bracket, minimum: six (6) screws per swivel bracket. Spaced evenly along bracket, with one (1) screw near each end.

ii. Internal mounted battery option: Not allowed .

iii. External battery cabinet option:

(a) Inverter/Charger, Power Transfer Relay and manually operated Bypass Switch shall fit inside a typical fully equipped Caltrans Model 332 Cabinet that includes one (1) Model 170.

(b) Batteries shall be housed in a NEMA 3R rated cabinet mounted to the side of the Model 332 Cabinet. This external battery cabinet shall conform to TEES, March 29, 2002 Chapter 7, Section 2-Housings for the construction and finish of the cabinet.

(c) Batteries shall be mounted on individual shelves.

(d) Four (4) shelves shall be provided. There shall be a minimum of three hundred four and eight-tenths millimeters (304.8mm, or 12") clearance between shelves. Each shelf shall be a minimum of two hundred twenty

eight and six tenths millimeters by six hundred thirty five millimeters (228.6mm x 635.0mm, or 9" x 25"), and capable of supporting a minimum of fifty-seven kilograms (57kg, or 125 lbs.)

(e) The external battery cabinet shall mount to the Model 332 Cabinet with a minimum of eight (8) bolts. (See Figure 5)

(f) The external battery cabinet shall be ventilated through the use of louvered vents, filter, and one thermostatically controlled fan as per TEES Chapter 7 Section 2-Housings.

(g) External battery cabinet fan shall be AC operated from the same line output of the Manual Bypass Switch that supplies power to the 332 Cabinet.

(h) The external battery cabinet shall have a door opening to the entire cabinet. The door shall be attached to the cabinet through the use of either a continuous stainless steel piano hinge or four (4), two-bolts per leaf, hinges as per TEES Chapter 7, Section 2. The door shall use a padlock clasp or latch and lock mechanisms as described in the TEES, in order to lock the door.

(i) The BBS with external battery cabinet shall come with all bolts, conduits and bushings, gaskets, shelves, and hardware needed for mounting.

iv. <u>Maintenance, displays, controls, and diagnostics:</u>

(a) The BBS shall include a display and /or meter to indicate current battery charge status and conditions.

(b) The BBS shall have lightning surge protection compliant with IEEE/ANSI C.62.41.

(c) The BBS shall be equipped with an integral system to prevent battery from destructive discharge and overcharge.

(d) The BBS and batteries shall be easily replaced with all needed hardware and shall not require any special tools for installation.

(e) The BBS shall include a front-panel event counter display to indicate the number of times the BBS was activated and a front-panel hour meter to display the total number of hours the unit has operated on battery power. Both meters shall have push button resets.

(f) Manufacturer shall include a set of equipment lists, Operation and Maintenance (O&M) Manuals, and board-level schematic and wiring diagrams of the BBS, and the battery data sheets. Manual shall conform to TEES March 29, 2002, Chapter 1, Section 1.2.4.2.

v. Battery system:

(a) Individual batteries shall be 12V type, 65 amp-hour maximum, and shall be easily replaced and commercially available off the shelf.

(b) Batteries used for BBS shall consist of four to eight (4-8) batteries with a cumulative minimum rated capacity of 240 amp-hours.

(c) Batteries shall be deep cycle, sealed prismatic lead-calcium based AGM/VRLA (Absorbed Glass Mat/ Valve Regulated Lead Acid).

(d) Batteries shall be certified by the manufacturer to operate over a temperature range of minus thirteen degrees Fahrenheit (–13° F) to one hundred sixty-six degrees Fahrenheit (166° F).

(e) The batteries shall be provided with appropriate interconnect wiring and corrosion-resistant mounting trays and/or brackets appropriate for the cabinet into which they will be installed.

(f) Batteries shall indicate maximum recharge data and recharging cycles.

(g) Battery interconnect wiring shall be via modular harness. Batteries shall be shipped with positive and negative terminals pre-wired with red and black cabling that terminates into a typical power-pole style connector. Harness shall be equipped with mating power-pole style connectors for batteries and a single, insulated plug-in style connection to inverter/charger unit. Harness shall allow batteries to be quickly and easily connected in any order and shall be keyed and wired to ensure proper polarity and circuit configuration.

(h) Battery terminals shall be covered and insulated so as to prevent accidental shorting.

vi. Quality assurance:

(a) Each BBS shall be manufactured in accordance with a manufacturer Quality Assurance (QA) Program. The QA program shall include two (2) Quality Assurance procedures:

(i) Design QA (see vii below) and

(ii) Production QA. The Production QA shall include statistically controlled routine tests to ensure minimum performance levels of BBS units built to meet this specification and a documented process of how problems are to be resolved.

(b) QA process and test results documentation shall be kept on file for a minimum period of seven (7) years.

(c) Battery Backup System designs not satisfying Design QA Testing and Production QA Testing requirements shall not be labeled, advertised, or

sold as conforming to this specification.

vii. Design qualifications testing:

(a) The manufacturer, or an independent testing lab hired by the manufacturer, shall perform Design Qualification Testing on new BBS system(s) offered, and when any major design change has been implemented on an existing design. A major design change is defined as any modification, either material, electrical, physical or theoretical, that changes any performance characteristics of the system, or results in a different circuit configuration. Where a dispute arises in determining if a system is a new design or if the system has had a major design change, the State will make the final determination if Design Qualification Testing is required prior to production consideration.

(b) A quantity of two (2) units for each design shall be submitted for Design Qualification Testing.

(c) Test units shall be submitted to Caltrans TransLab, Electrical Testing Branch after the manufacturer's testing is complete.

(d) Manufacturer's testing data shall be submitted with test units for Caltrans verification Design Qualification Testing.

viii. Burn in:

(a) The sample systems shall be energized for a minimum of five (5) hours, with full load of 700 watts, at temperatures of minus thirty-five degrees Fahrenheit (–35° F) and one hundred sixty-six degrees Fahrenheit (166° F), excluding batteries, before performing any design qualification testing.

(b) Any failure of the BBS, which renders the unit non-compliant with the specification after burn in, shall be cause for rejection.

(c) For Design Qualification Testing, all specifications will be measured including, but not limited to:

(i) Run time while in battery backup mode, at full load.

(ii) Proper operation of all relay contact closures ("On-Batt", "Low-Batt" and "Timer").

(iii) Inverter output voltage, frequency, harmonic distortion, and efficiency, when in battery backed inverter mode.

(iv) All power transfer voltage levels. See BBS Specifications 1.8, 1.11 and 1.12.

(v) Power transfer time, from loss of utility line voltage to stabilized inverter line voltage, from batteries.

(vi) Backfeed voltage to utility when in battery backed inverter mode.

(vii) IEEE/ANSI C.62.41 compliance.

(viii) Battery charging time.

(ix) Event counter and runtime meter accuracy.

ix. Production quality control testing:

(a) Production Quality Control tests shall consist of all of the above listed tests and shall be performed on each new system prior to shipment. Failure to meet requirements of any of these tests shall be cause for rejection. The manufacturer shall retain test results for seven (7) years.

(b) Each BBS shall be given a minimum one hundred (100) hour burn in period to eliminate any premature failures.

(c) Each system shall be visually inspected for any exterior physical damage or assembly anomalies.

(d) Any defects shall be cause for rejection.

21.25 TRAFFIC SIGNAL INTERCONNECT CONDUIT

a. The lump sum price for traffic signal installation and hardware shall include the cost of furnishing and installing conduit, for a future traffic signal interconnect, of the sizes specified in the approved Construction Drawings in a trench in the street at the depth required by either the approved Construction Drawings, these Standard Specifications, or the Special Provisions; and all work associated with conduit installation including, but not limited to, protection of existing traffic detection, Type 6E pull boxes, backfilling, paving, and providing sweeps into pull boxes.

b. Installation of all equipment, materials, and components for traffic signal interconnect system, pursuant to the provisions of the State of California Standard Specifications, State Standard Plans, these Standard Specifications, and the Special Provisions.

c. All conduits shall be rigid metal type or electric grey, schedule 40 PVC.

d. When a standard coupling cannot be used for coupling metal type conduit, a UL-listed threaded union coupling, as specified in the third paragraph in Section 86-2.05C "Installation" of the State of California Standard Specifications, or a concrete-tight split coupling or concrete-tight set screw coupling shall be used.

e. All conduit runs into pull boxes shall have a forty-five degree (45°) sweep.

f. Installation of Type 6E pull boxes shall include the cost of furnishing and installing each new Type 6E pull boxes within the interconnect system as specified in the

approved Construction Drawings and the Special Provisions and all work associated with installation of said pull boxes.

g. Grout shall be placed in bottom of standard pull boxes. Cover markings shall be per Caltrans Standard Plan ES-8 except that the word "Caltrans" shall be omitted. Pull boxes not protected by curb shall be traffic bearing.

h. The Contractor shall install pull ropes in all traffic signal interconnect conduit.

i. Protection and restoration of existing improvements shall comply with Section 7.13 "Preservation of Property" of these Standard Specifications.

j. The Contractor shall be responsible for the protection of public and private property adjacent to the work and shall exercise due caution to avoid damage to such property.

k. The Contractor shall contact USA to request marking of all utilities in the project area. The Contractor shall determine the exact location and depth of all potentially conflicting utilities or other improvements, prior to doing any work that could potentially interfere with or damage such facilities. This applies to any utility marked via USA, utilities shown on any sheet of the approved Construction Drawings, or whose presence can be inferred from conditions visible or evident at the job site, including markings, meters, trenches, manholes, handholes, pedestals, structures, valves, or buildings. Where possible, the location of the conduit and pull boxes shall be adjusted in the field to avoid conflicts with any utilities.

l. The Contractor is required to submit to the Engineer "Record Drawings" prints, prior to the City's accepting the installations. The prints shall indicate in red all deviations from the approved Construction Drawings such as location of poles, pull boxes and runs, depths of conduit, number of conductors and other appurtenant work for future references.

m. Full compensation for labor, material, equipment, pull boxes, sweeps, bends, hardware, backfill, paving, and appurtenances required for the installation of traffic signal interconnect conduit shall be included in the lump sum price paid for the traffic signal installation and hardware and no separate payment will be made, therefore.

21.26 MEDIAN LIGHTING

a. The contract, lump sum price paid for median lighting, shall include full compensation for furnishing all labor, materials, tools, equipment, conduits, pull boxes, trenching and incidentals and for doing all the work involved in median lighting, complete in-place, including providing the electrical service, as shown in the approved Construction Drawings, as specified in these Standard Specifications and the Special Provisions, and as directed by the Engineer.

b. Description: Install all equipment, materials, and components for traffic signals and highway safety lighting system, pursuant to the provisions of the State of California

Standard Specifications, Section 86 "Signals, Lighting, and Electrical Systems", State Standard Plans, and these Standard Specifications..

c. Foundations: Portland cement concrete shall conform to Section 90-10, "Minor Concrete," of the State of California Standard Specifications and shall contain not less than four hundred seventy pounds (470 lbs) of cement per cubic yard.

d. Safety and Street Lighting: Luminaries used for safety and street lighting shall be GE M2AC15S7H2GMC31 or equal. A twist-lock photo-electrical control unit and receptacle shall be installed on each luminaire. Luminaire to be provided by the Contractor, and installed by the Contractor.

e. All Luminaires to be mounted on horizontal mast arms, when tested in accordance with California Test 611, shall be capable of withstanding cyclic loading in:

   i. A vertical plan at a minimum peak acceleration level of 3.0 g's peak-to-peak sinusoidal loading (same as 1.5 g's peak) with the internal ballast removed for a minimum of two million cycles without failure of any luminaire parts, and

   ii. A horizontal plan perpendicular to the direction of the mast arm at a minimum peak acceleration level of 1.5 g's peak-to-peak sinusoidal loading (same as 0.75 g's peak) with the internal ballast installed for a minimum of two million cycles without failure of any luminaire parts.

f. No part of the slipfitter mounting brackets on the luminaries shall develop a permanent set in excess of two hundredths of one inch (0.02") when the four (4) three-eighths of one inch (⅜") diameter cap screws used for mounting are tightened to a torque of ten foot pounds.

g. Ballast's shall be the lag regulator type.

h. Lamps used in safety lighting luminaries shall be as specified on the approved traffic signal Construction Drawings.

i. Lamps used in street lighting shall conform to Section 86-6 of the State of California Standard Specifications and be 150 watts, 240-volt, high-pressure sodium, and operate at 16,000 lumens, unless stated otherwise in the approved Construction Drawings.

j. Each light shall have a fuse protection located in the pull box next to the lighting standard.

k. Standards used for street lighting shall be pre-stressed concrete octagonal pole equal to the Ameron 1C1 Series. Pole length shall be twenty-five feet and nine inches (25' -9"). Pole finishes shall be blasted black and white aggregates with no protective coating. Concrete lighting poles shall be ordered as double arm as shown in the approved Construction Drawings.

l. Luminaire arms shall be eight feet (8') long. Material shall be of Carson-Steel sheets and strip structural quality, ASTM Designation: A750, Grade C. Arm

mounted on poles shall be perpendicular to street.

m. Material:

i. Pull boxes: Christy N30 (Caltrans No. 5) or approved equal with a twelve inch (12") extension.

ii. Light standards:

(a) Pole length - twenty five feet and nine inches (25' -9")

(b) Arm length - eight feet (8') (double mast arm)

(c) Pole - Ameron Series 1C1 pre-stressed concrete pole

n. Payment: Full compensation for furnishing all labor, equipment, and tools for doing all work in performing the requirements and specifications herein shall be considered as included in the contract lump sum for median lighting, conduits, pull boxes, and electrical services and no additional compensation will be allowed therefore.

i. Full compensation for hauling and stockpiling electrical material including excavation necessary for bases shall be considered as included in the contract lump sum for median lighting, conduits, pull boxes, and electrical service and no additional compensation will be allowed therefore.

ii. Full compensation for all conductor including pull rope necessary and associate with the street lights, pull boxes, electrical boxes, boring, circuit and breakers to complete the project to working order shall be considered as included in the contract lump sum price paid for median lighting, conduits, pull boxes, and electrical service and no additional compensation will be allowed therefore.

iii. Full compensation to provide and install the electrical service pedestal and coordination with Southern California Edison shall be considered as included in the contract lump sum price paid for median lighting conduits, pull boxes and electrical service and no additional compensation will be allowed therefore.

21.27 PAYMENT

Full compensation for the items described in Section 22 of these Standard Specifications and any other work necessary for completion of the work not specifically described in the approved Construction Drawings or these Standard specifications, complete in place, as shown in the approved Construction Drawings, as specified in these Standard Specifications and the Special Provisions, and as directed by the Engineer shall be considered as included in the contract lump sum price paid for "Traffic Signal Installation and Lighting" and no additional compensation will be allowed therefore.

Note: Key all locks to match standard City keys. Controller cabinet lock shall match standard City controller cabinet key. Police panel lock shall match standard City police panel key. Battery back up cabinet lock shall match controller cabinet key.

SECTION 22 – WATER SERVICE

22.01 MATERIALS

a. Ductile Iron (DI) Pipe: All Ductile Iron pipe shall comply with the latest revision of American Water Works Association (AWWA) Standard C151 and shall be cement mortar lined in conformance with the latest revision of AWWA Standard C104. All pipe shall have push-on joint ends complete with gasket unless specified otherwise and shall be Pressure Class 350 in all sizes from six inches (6") to twelve inches (12") unless specified otherwise. Pipe shall be furnished with polyethylene encasement complying with the latest revision of AWWA Standard C105. All pipe shall be manufactured by Pacific States, Clow/McWane, U.S. Pipe, or Griffin pipe.

b. Polyvinyl Chloride (PVC) Pipe: All pipe shall be Class 150, D.R. 18, unless otherwise specified and shall comply with the latest revision of AWWA Standard C-900. The pipe shall have ductile-iron pipe equivalent outside diameter dimensions and shall have push-on joint ends complete with gaskets. All pipe shall be manufactured by PW pipe, J-M Pipe, CertainTeed, Diamond Plastic Corp., Vinyl Tech, Uponor, or Royal Pipe.

c. Cement Mortar Lined and Cement Mortar Coated Steel Pipe (CL&C): All cement mortar lined and coated steel pipe shall be fabricated from steel cylinder ASA schedule as indicated on the drawing, with American Society for Testing and Materials (ASTM) A53 test pressure and ASTM A36 physical properties. Cement mortar protective coating shall be three-fourths of one inch (¾") for all pipe sizes. The lining shall be one-half of one inch (½") for twelve inch (12") and larger pipe and three-eighths of one inch (⅜") for six inch (6") and eight inch (8") pipe, and conform to the latest revision of AWWA C205 Standard. Cement Mortar Coating shall be reinforced with fourteen gauge (#14) wire mesh or spirally wound wire in center of coating. All CL&C steel pipe required for the water main installation shall be as specified on the drawing.

d. PVC "Certa-Lok" VIP Restrained Joint Pipe: All PVC "Certa-Lok" VIP Restrained Joint pipe shall be manufactured by CertainTeed. Certa-lok shall comply with the latest revision of AWWA Standard C-900. Pipe is made to ductile-iron-outside-diameter (DI OD), DR 18, Class 150, in twenty foot (20') laying lengths, with twin gasket Certa-Lok couplings, nylon splines, and rubber rings.

e. Steel (Stl) Pipe:All Steel pipe shall be as specified on the drawings.

f. Polyethylene (PE) Pipe: This Section is for PE pipe for mains or services sizes four inch (4") and larger and shall only be used when specified on the drawings. All PE pipe shall be high density polyethylene (HDPE) complying with the latest revision of AWWA Standard C906 and Plastic Pipe Institute (PPI) PE 3408. PE pipe shall conform to the outside diameter for the ductile-iron sizing system (DI OD) in Table 7 of AWWA C906. For water mains where working pressure will be less than one hundred pounds per square inch (100 psi), SDR 17 shall be used. For working pressure between one hundred pounds per square inch and one hundred sixty pounds per square inch (100 psi - 160 psi), SDR 11 shall be used. All pipe shall conform to National Science Foundation (NSF) Standard #14 and #61. All pipe shall either be blue or have blue printing on it to designate its use as a potable

water pipeline. HDPE pipe shall be manufactured by CP Chem (Performance Pipe-Driscoplex).

g. Pipe Fittings: All fittings shall be as specified on the drawings and shall be Ductile Iron complying with the latest revision of AWWA Standard C153 for push-on and mechanical joints fittings and C110 for flanged fittings. All fittings shall either be cement mortar lined in conformance with the latest revision of AWWA Standard C104 or coated with fusion-bonded epoxy inside and outside in conformance with the latest revision of AWWA Standard C116. All fittings shall be manufactured by U.S. Pipe, Union/Tyler, Sigma Corp., or Star Pipe.

h. Gate Valves: All gate valves shall meet or exceed the latest revision of AWWA Standard C515 for reduced wall, resilient-seated gate valves (or C509 for resilient-seated gate valves) and shall be provided with left hand to open, ductile iron (or cast iron) body with epoxy coating inside and outside complying with the latest revision of AWWA Standard C550, nut operated non-rising stem with two inch (2") square operating nut, two (2) O-ring stem seals above the thrust collar and one (1) below, O-ring gaskets and 304 stainless steel bolts and nuts on bonnet and stuffing box and ethylene propylene diene monomer (EPDM) rubber encapsulated wedge (when available at no extra cost). All gate valves shall be manufactured by Mueller Company, M & H Valve and Fitting Company, Kennedy Valve Co., Clow Valve Co., American Flow Control, American AVK Co. or U.S. Pipe. Two inch (2") and smaller gate valves shall be Class 125 with standard thread, bronze with wheel, and be manufactured by Milwaukee (No. 105) or Nibco.

i. Butterfly Valves: All valves greater than twelve inches (12") nominal size shall be butterfly valves. All butterfly valves shall comply with the latest revision of AWWA Standard C504, and shall be provided with "O-ring" packing, left hand to open, nut operated with two inch (2") square operating nuts, ductile iron body, stainless steel shaft, resilient seat and heavy duty actuator. The butterfly valves shall be manufactured by Mueller Company, M & H Valve & Fitting Company, Pratt Company or Kennedy Valve Co.

j. Pressure Reducing Valves (PRV): All pressure reducing valves shall be manufactured by Cla-Val Company. The model number, body construction, and flange drilling shall be as specified on the drawings. All valves shall have factory set controls or pilots as specified on the drawings. All control or pilot piping shall be copper tubing or brass pipe. PRV vaults shall be as specified on the drawings.

k. Check Valves: Unless specified otherwise, all check valves shall be swing type with spring and lever and shall comply with the latest revision of AWWA Standard C508. The valves shall have Class 125 flanged ends unless shown otherwise on the Construction Drawing. Check valves shall be manufactured by Mueller, Clow, M&H, or Kennedy.

l. Valves for Tapping: All gate valves for tapping purposes shall be resilient seat type valves. The valve for tapping shall be manufactured by Mueller Co., Kennedy Valve Co. or Clow Valve Co.

m. Tapping Sleeves: All tapping sleeves shall be all stainless steel including flange and shall only be used when specified in the approved Construction Drawings by the City. Tapping sleeves shall be JCM Model 432, Mueller Model H304, Smith Blair 662-663 or Ford style FTSS.

n. Valve Casings and Covers: All valve casings and covers shall be fabricated as shown in the City of Visalia, Engineering Improvement Standards.

o. Fire Hydrants: All fire hydrants shall be as specified on the district specific drawing or as approved by City personnel. For typical Fire Hydrant details see the City of Visalia, Engineering Improvement Standards.

p. Fire Hydrant Burys: All fire hydrant burys shall be manufactured from Ductile Iron to ASTM A536 and have a minimum working pressure rating of two hundred pounds per square inch (200 psi). Burys shall be manufactured by Clow, SBF, Sigma, or Star Pipe.

q. Service Materials: All one inch (1") and two inch (2") service material specifications except copper tubing and plastic PE pipe shall be as shown in the City of Visalia, Engineering Improvement Standards, which includes alternate manufacturers. All service material specifications for services larger than two inch (2") shall be as specified in the approved Construction Drawings and/or as specified in the City of Visalia, Engineering Improvement Standards for that size service.

r. Saddles: All saddles shall be as specified in the City of Visalia Engineering Improvement Standards.

s. Solder: All solder shall be lead free.

t. Copper Tubing: All copper tubing shall conform to the latest revision of ASTM Specification B88 and be Type K soft.

u. Polyethylene (PE) Service Pipe: All PE plastic pipe for services shall comply with the latest revision of ASTM D2239 with a Standard Code Designation of PE 3408. Dimensions and tolerance of pipe shall be as specified in Table 3 of the latest revision of AWWA Standard C901 for PC 200-IDR7. This is a high density polyethylene plastic pipe conforming to the inside-diameter dimensions of iron pipe sizes and having a two hundred pounds per square inch (200 psi) pressure rating. The pipe shall be approved by NSF as suitable for potable water products.

v. Meter Boxes: All meter boxes for one inch (1") services and two inch (2") services shall be as specified in the City of Visalia, Engineering Improvement Standards. All meter boxes for services larger than two inch (2"), shall be as specified in the approved Construction Drawings and/or as specified in the latest revision of the City of Visalia Engineering Improvement Standards for that size service. All meter boxes for one inch (1") services and two inch (2") services shall be supported by placing bricks or two inch by four inch (2"x4") pressure treated lumber under two (2) sides of the base of the meter box.

w. Vaults: Vaults for appurtanences other than meters (such as Check Valves or PRV's) shall be as specified on the drawings.

x. Machine Bolts: All steel bolts and nuts used for flanged fittings, flexible couplings, or other bolted appurtenances shall be 304 stainless steel. Ductile iron bolts are acceptable when the appurtenance is made of ductile iron and comes with option of ductile iron bolts, such as mechanical joint fittings. Anti-gaul lubricant shall be used with stainless steel bolts & nuts.

y. Two Inch (2") Blow Off Assemblies: All materials for two inch (2") blow off assemblies shall be as shown in the City of Visalia, Engineering Improvement Standards

z. Flexible Couplings: The City may require flexible couplings to be epoxy coated if soil conditions are determined to be corrosive. If the flexible coupling is steel the sleeve must be a minimum of ten inches (10") long. If the flexible coupling is ductile iron then a standard sleeve length may be used unless the drawing specifies otherwise. Flexible Couplings shall be manufactured by Smith Blair, Ford Meter Box Company, or Romac Industries.

aa. Solid Sleeves: All solid sleeves shall be made of ductile iron and shall be manufactured by Tyler Pipe or Union/Tyler Foundry.

bb. PVC High Deflection Couplings: All PVC high deflection couplings shall conform to the latest revision of AWWA C-900 and shall be manufactured by CertainTeed.

cc. PVC Closure Couplings: All PVC closure couplings shall conform to the latest revision of AWWA C-900 and shall be manufactured by CertainTeed.

dd. Two Inch (2") Ball Valves: Two inch (2") ball valves shall be as shown on the Construction Drawing and shall be manufactured by Mueller, James Jones, Ford Meter Box Company or AY McDonald.

ee. Tracer Wire: Tracer wire shall be minimum twelve gauge (#12) solid copper wire with forty-five millimeters (45 mils) of High Molecular Weight Polyethylene (HMWPE) insulation, UL Listed, rated for direct burial, color blue and installed with all pipe including PVC, polyethylene and ductile iron pipe. For installation details see the City of Visalia, Engineering Improvement Standards.

22.02 INSTALLATION OF DUCTILE IRON AND POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND APPURTENANCES

a. Permits: All specification sheets, city/county or other environmental permits necessary for the installation of facilities must be obtained by the Contractor and be on the job site prior to and during construction.

Compliance with all the Rules and Regulations of the California Occupational Safety and Health Act (CAL OSHA), Public Law 91-596, the "Williams' Steiger Occupational Safety and Health Act of 1970", is required on this project. The work practices for all pipe shall be in accordance with the latest revision of the AWWA

Publication C-600 Standard for Installation of Ductile Iron Water Mains and their Appurtenances, C-605 Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and fittings for water, and M23 Manual of Water Supply Practices for PVC Pipe-Design and Installation.

Please note direct discharge of highly chlorinated water to the environment is expressly prohibited. Refer to Section 22.04 "Dechlorination of Flushed Water" in these Standard Specifications for more information. The Contractor shall comply with environmental laws and regulations as set forth by all federal, state and local agencies.

b. Materials: All materials installed for the facilities to be constructed by the Contractor must comply with the approved Construction Drawings and Section 22.01 " Material" in these Standard Specifications. No materials are to be supplied or furnished by the City unless specifically indicated in the approved Construction Drawings for special installations. All materials must be on the job site and inspected prior to start of construction. Any pipe, valve, or appurtenance whether installed or not, which in the opinion of the City, does not meet the requirements of these Standard Specifications or otherwise found unfit, shall be rejected as being unfit, and shall be immediately removed from the job site.

c. Line and Grade: The horizontal and vertical alignment for installation of the pipe shall be established in the field by the Contractor in accordance with the approved Construction Drawings, these Standard Specifications and the Special Provisions. Location of water facilities including finished grades and elevations shall be staked with offsets on site by the Contractor prior to start of construction. Final elevations of installed facilities, meter boxes, valve covers, hydrants, etc. shall be signed off by a City representative prior to acceptance of facilities.

d. Cover: Under normal conditions all mains shall be covered to a depth of four feet (4') below the finished grade over the pipeline, unless specified otherwise in the approved Construction Drawings. Prior approval must be obtained from the City to install mains with greater or less than four feet (4') of cover.

e. Separation Between Water Mains and Sanitary Sewers or other Facilities: Water mains shall be installed at least ten feet (10') horizontally from and one foot (1') higher than sanitary sewers located parallel to the main, unless specified otherwise in the approved Construction Drawings. Install water mains a minimum of one foot (1') higher than sanitary sewers crossing the mains. At all storm and sanitary sewer crossings, a full pipe length shall be centered over the sewer pipe to keep an adequate distance between the sewer and the water pipe joints. A twenty foot (20') length of PVC or eighteen foot (18') length of DI pipe is considered to be a full pipe length. The State of California Department of Health Services "Criteria for the Separation of Water Mains and Non-potable Pipelines" shall be followed when installations cannot meet the "Basic Separation Standards". A minimum vertical clearance of twelve inches (12") shall be maintained between the water main and all foreign structures, and a minimum horizontal clearance of five feet (5') shall be maintained between utilities unless otherwise indicated in the approved Construction Drawings or approved by the City. Refer to "Pipeline Crossing

Information" shown in the City of Visalia Engineering Improvement Standards for information of water main installations crossing other proposed or existing facilities. City approval must be obtained prior to making any changes from the approved Construction Drawings. This includes changing grade or alignment to avoid structures, other pipes, manholes, or any other fixed objects which may be encountered during installation. As per City standards, changes in cover over the pipeline may require the installation of a fabricated steel, cement mortar lined and coated offset.

f. Workmanship: The pipe shall be installed to a true line and grade except on curves where ductile iron pipe may be installed with joint deflections between adjacent lengths of pipe not to exceed three degrees (3°) for ductile iron pipe sizes six inches (6"), eight inches (8"), and twelve inches (12"). PVC pipe shall not be deflected at joints for horizontal or vertical deflection. No joint deflection shall be allowed in joints between fittings and pipe. "Certainteed" PVC Deflection Couplings shall be used with PVC C-900 between adjacent lengths of pipe to attain up to five degrees (5°) deflection at the joint when required.

   When assembling a PVC pipe to an iron fitting, valve, or appurtenance (push-on), remove all but one-fourth of one inch (¼") of the factory made bevel from the spigot end of the pipe. Bottom the pipe in the bell of the iron fitting.

   Field-cut lengths of PVC and DI pipe may be used for making connections to valves, fittings, appurtenances, and closures where necessary. The cutting and beveling of the pipe for inserting into the bell shall be done by the use of a square cutting tool approved by the City and manufactured for this purpose, without damage to the pipe. The bevel of the pipe shall be the same as required for the fitting.

g. Trench Bottom: The bottom of the trench shall be smooth and free from pieces of rock or other material that would tend to scratch, puncture or break the pipe or damage the polyethylene encasement used on ductile iron pipe. If rocks or stones are encountered, they shall be removed to a depth of six inches (6") below bottom of trench and the void filled with material tamped to grade. A six inch (6") layer of sand shall be placed in the trench bottom to provide a firm, stable, and uniform support for the full length of the pipe, except at the joints where bell holes shall be dug two inches (2") below the surface so that the pipe will not be supported by the joint. Under no circumstances shall the bell hole undermine the support for the fittings or valves.

   Valves and other various fittings may be required to be supported by a concrete cradle if it is determined by the City that the bedding in the trench bottom cannot be properly compacted to provide adequate support.

   When an unstable subgrade condition is encountered that could provide inadequate pipe support, the City shall require additional trench depth to be excavated, refilled and compacted with suitable foundation material.

   PVC or DI pipe or appurtenance shall not be laid in water, or when, in the opinion of the City, the trench conditions or the weather are unsuitable for construction.

Any water main which has been submerged shall be removed from the trench and be re-laid. The trench shall be dewatered whenever running or standing water occurs in the trench bottom and the removal shall continue until the pipe has been installed and the backfill has been placed to a sufficient height to prevent the pipe from being submerged in water.

IMPORTANT: All trench excavations shall be in accordance with the Rules and Regulations of the CAL OSHA. This includes all necessary shoring determined by either the depth of trench and/or soil conditions.

h. Pipe and Appurtenances Handling: All water main and appurtenances shall be carefully lowered into the trench by means of padded slings, hooks, pipe tongs, or other suitable equipment consistent with safety, in such a manner to prevent damage to the exterior and interior pipe or appurtenance surfaces. Under no circumstances shall any material be dropped or dumped into the trench. Any foreign material inside the pipe shall be removed and the interior of the pipe kept clean during installation. PVC pipe, ductile iron pipe, or appurtenance with damaged exterior or interior surfaces shall not be installed.

During installation the open ends of the pipe shall be covered at night or when no work is in progress at that point to prevent entrance of trench water, animals, or other foreign matter.

On all pipe, a continuous strip of tracer wire (per material specification) shall be taped to the top exterior surface of the pipe per the City of Visalia, Engineering Improvement Standards. Tracer wire splices using appropriate connectors are required at all locations where the wire is cut.

A polyethylene encasement shall be installed over ductile iron pipe, fittings, and appurtenances per latest revision of AWWA Standard C105 Polyethylene Encasement for Ductile Iron Piping and per the approved Construction Drawings, these Standard Specifications and the Special Provisions, or as requested and directed by the authorized City representatives.

Note: Ductile iron fittings and appurtenances installed on PVC C-900 main shall require polyethylene encasement with a two feet (2') overlap onto the PVC main. This overlap to be secured to main per the latest revision of AWWA Standard C105.

i. Rubber Ring Joints for PVC C-900 and Ductile Iron Pipe: Push-on type rubber ring joints with rubber rings for integral bell ends shall be joined as follows: The ring groove, bell socket and plain end should be wiped clean. Insert the gasket making sure that it faces the proper direction and that it is correctly seated. The plain end shall be beveled and free of any sharp or ragged edges which may damage or dislodge the gasket. Lubricate the entire outside end of the pipe including the pipe bevel, also lubricate the exposed portion of the rubber ring gasket in the bell (See "pipe joint lubricant" below). Push the plain end into the bell by hand or with the use of a bar and block until it is completely seated, keeping the joint straight while pushing. Construction machinery shall not be used to push the pipe into a pipe bell end or a fitting bell end. After assembly, the resulting position of the rubber ring

shall be checked with a feeler gauge.

If "Field Lok" gaskets are specified in the approved Construction Drawings, the gasket shall be installed in accordance with the manufacturer's recommendations.

If "TR FLEX" restrained joint system is specified in the approved Construction Drawings, the joint assembly shall be installed in accordance with the manufacturer's recommendations.

j. Pipe Joint Lubricant: Pipe joint lubricant shall be as specified by the pipe manufacturer and shall be NSF approved for use in potable water systems. When specified by the City, or at the option of the Contractor, Slikstyx spray-on gasket lubricant may be used as an alternative to the traditional lubricant supplied by the pipe manufacturer. This spray-on lubricant may be helpful in reducing taste and odor complaints from excessive traditional lubrication, particularly on dead end mains.

When using Slikstyx, follow these instructions: After cleaning the bell and spigot of all grease, dirt, or foreign material, apply a thin film of Slikstyx gasket lubricant to the gasket and pipe spigot. Use care on rolled fittings and PVC high deflection couplings, as the product will set up and cause difficulty in manipulating fittings. If the pipe will be installed for a long period before attempting to roll a fitting, the traditional pipe lubricant should be considered. One (1) sixteen fluid ounce (16fl oz.) can of Slikstyx will cover approximately forty (40) six inch (6") joints, thirty (30) eight inch (8") joints or twenty (20) twelve inch (12") joints. Slikstyx gasket lubricant is currently distributed by Future Tools, Inc., Wellston, OH 45692, 1-800-576-9707.

k. Mechanical Joints: Mechanical joints shall be joined as follows: The socket and plain end should be wiped clean and any excess coating in the bell should be removed. The plain end, bell socket, and gasket should be washed with a soap solution or lubricant furnished with the gaskets to improve the seating of the gasket in the socket and to help the various parts slide together along the pipe. Place the gland on the plain end with the lip extension toward the plain end of the pipe, followed by the gasket with the narrow edge of the gasket toward the end of the pipe. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during the assembly. Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Partially tighten the bottom bolt first; then the top bolt; next the bolts at either side; and finally the remaining bolts. Repeat this process until all bolts are torqued to a value between seventy-five foot pounds (75 ft lbs) and ninety foot pounds (90 ft lbs).

If "Mega Lug" mechanical joint retainer glands are specified in the approved Construction Drawings, the gland assembly shall be installed in accordance with the manufacturer's recommendations.

l. Thrust Blocks: Concrete thrust blocks shall be provided for all fittings to prevent movement when the main is under pressure. This includes tees, ells, reducers, caps and plugs. Forms are required and are to be provided by the Contractor. These forms shall be smooth, mortar tight and of sufficient strength to maintain shape during the placing of the concrete. All concrete thrust blocks shall be constructed per the City of Visalia, Engineering Improvement Standards.

m. Embedment Backfill: The embedment backfill is six inches (6") of sand bedding below the pipe and twelve inches (12") of sand backfill above the pipe (see sand definition below). Care must be taken to compact the sand backfill material solidly around and under the pipe. Small tampers and vibrators are allowed for compacting near the pipe and over the pipe after a minimum of six inches (6") of sand backfill has been placed over the pipe. Flooding, jetting or puddling may be employed for compaction in the first lift although great care must be taken to prevent drainage or flotation of the pipeline. Apply only enough water to give complete saturation. Erosion of support at the pipe sides and bottom by water jetting must be prevented. Rocks or hard lumps are not permitted in the embedment backfill or final backfill.

Sand is defined as material free from organic matter and clay with a sieve gradation by weight as follows:

Sieve Size	% Passing Sieve
No. 4	100
No. 200	0 - 5

n. Final Backfill: In areas where required, the permanent pavement and temporary pavement replacement must comply with Section 15. All backfill above the sand embedment backfill must meet compaction requirements according to Section 12. All pavement broken shall be replaced in strict accordance with the requirements of Section 15.

o. Other Facilities: All existing facilities, such as but not limited to sewers, gas mains, water mains, telephone conduits, and power or telephone poles which may be located close to trench operations must be protected by the Contractor. If any of these facilities are damaged by the Contractor, repairs shall be made to the satisfaction of the interested parties at the Contractor's expense.

p. Valve Casings and Covers: A valve casing with cover shall be installed for each gate valve, butterfly valve, two inch (2") blow off assembly or when specified in the approved Construction Drawings per the City of Visalia Engineering Improvement Standards. The valve cover and frame for valves in paved and unpaved areas shall be per the City of Visalia, Engineering Improvement Standards. The valve cover frame shall be set in a ring of concrete a minimum of twenty-four inches (24") in diameter and three inches (3") thick. All valve casing covers must be placed flush with the finished grade of the surrounding area.

q. 2" Blow Off Assemblies: A blow off assembly as shown in the City of Visalia, Engineering Improvement Standards shall be installed for each dead end capped main. The assembly is to include a valve casing and cover.

r. Services and Meter Boxes: Services and meter boxes shall be installed as shown in the City of Visalia, Engineering Improvement Standards for one inch (1") services, for two inch (2") services, and for larger than two inch (2") services as designated in the approved Construction Drawings and/or the latest revision of the Engineering Improvement Standards for that size service. The one inch (1") and two inch (2") service pipe shall be installed at a depth of thirty inches (30") or more from finished grade over the service pipe and in no event shall the depth be less than eighteen inches (18"). The Contractor must get prior approval from the City to install service pipe with less than thirty inches (30") of cover.

All meter box locations must be approved by the City and the boxes must be installed flush with finished grade of the surrounding area at the meter box cover. The meter boxes for one inch (1") and two inch (2") services shall be supported by placing a two inch by four inch (2"x4") treated lumber or bricks on two (2) sides of the meter box's base. Avoid postal and street pedestals, driveways, trees/bushes, fencing, sewer lines, and other utilities.

Saddles and saddle tapping are required for all service connections made on PVC pipe. When making this type of connection, proper equipment must be used which attaches to the corporation stop permitting the cutting tool to be fed through the corporation stop to cut a hole in the pipe. It is important that the cutting tool be a sharp shell type (hole) cutter which will retain the coupon and be designed to accommodate walls as heavy as DR 18 pressure Class 150. The shell cutter shall be lubricated on the outside only and not on the inside of the cutter with a recommended lubricant. Do not drill a hole in the PVC pipe with a twist drill or auger bit.

Direct tapping machines for service connections on ductile iron pipe must be approved by the City prior to direct tapping ductile iron mains. Plastic PE pipe is to be cold flared to match recessed fittings or is to have outside end bevels for Instatite fittings. Forming tool for bevels shall be Mueller's beveling tool number H10817 or approved equal.

s. Connection to Existing System: The Contractor shall furnish to the City the necessary fittings, valves, pipe, and joint material required to connect the new mains to the existing system.

The Contractor must adjust from the nominal line and grade to match the existing facilities.

The Contractor is to complete the piping and maintain the specified clearance from existing main as shown on the drawings. The Contractor shall make the excavation for the tie-in. The trench shall be left in a safe condition for the Contractor to complete the connections. If the trench is considered unsafe for workers, the City may require the Contractor to return and adequately excavate for the tie-ins at the Contractor's expense. After the City has inspected the connection, the Contractor shall install concrete thrust blocks, install valve casings and covers, and backfill the excavation. The Contractor shall then replace any pavement that was cut for the excavation.

The City reserves the right to perform the tie-ins to the existing system if they desire. In this situation, the Contractor will not be paid for the tie-ins as bid.

t. Pressure Test: Prior to any testing, at least seven (7) days should elapse after the last concrete thrust block was poured if Type I portland cement was used and three (3) days if high-early-strength Type III portland cement was used. A preliminary pressure test shall be made by filling the mains with water and allowing them to stand under regular system pressure for a period of at least twenty-four (24) hours. After completion of the preliminary test, the Contractor shall make a hydrostatic test by raising the pressure in the main to fifty pounds per square inch (50 psi) above the normal static pressure at the point of observation with a minimum test pressure of one hundred fifty pounds per square inch (150 psi). A calibrated pressure chart recorder and a water meter shall be provided by the City. The hydrostatic test shall not be conducted without a City representative present. The pressure that the test is started at shall be maintained for a minimum of four (4) hours. The test shall start and finish at the same pressure. If there is a pressure drop, the Contractor shall pump more water into the main through the water meter to bring the main back to its starting pressure. The leakage is the calculated volume of water pumped into the main through the meter. The leakage shall be measured accurately during the test period to determine that the leakage rate does not exceed the values shown in *Table 22.02 A* for ductile iron pipe and *Table 22.02 B* for PVC C-900 pipe. There shall be no leakage, zero gallons per four hours (0 gal/4 hr) test period at one hundred fifty pounds per square inch (150 psi) for the portion of pipeline that is steel pipe CL&C with welded joints. An air test may be used as an alternate method on the steel pipe CL&C welded sections. Test pressure to be one hundred fifty pounds per square inch gauge (150 psig) held for a four (4) hour duration, with no volumetric loss during test period. A calibrated pressure chart recorder will be provided by the authorized testing agency. The necessary taps, connecting pipe, and valve fittings shall be provided by the Contractor. Any leaks or failures that develop during the test shall be repaired by the Contractor immediately.

   If the mains fail to meet requirements of the hydrostatic test, the Contractor shall, at his expense, make repairs to reduce the leakage. The repair work shall be continued until a satisfactory test is made.

u. Disinfection of Mains: All mains that are installed by the Contractor shall be disinfected by the Contractor in accordance with Section 22.03 “Disinfection of New Mains.”

v. Inspection: The City reserves the right of access to the work at all times for the purpose of inspecting and the Contractor shall permit the City’s representative to make an inspection at any time. The Contractor shall notify the City’s Inspector at least forty-eight (48) hours prior to any work being started at the project site. The City will normally provide no more than two (2) inspections per day during normal working hours. The trench must be left open until the City has inspected the new installation and approved that portion of trench to be covered. If the trench is covered prior to the City’s inspection, the Contractor will be required to uncover the trench at the Contractor’s expense.

w. Protection: The Contractor shall at all times provide suitable and adequate danger signals and barricades. If necessary, the Contractor shall also provide temporary bridges across the trench to permit free ingress and egress to and from private driveways or traveled roads or streets. No street shall be closed unless a permit has been obtained from the City.

x. Specifications and Drawings: Specifications and drawings shall be taken together and anything shown on the drawings and not covered by the specifications or covered by the specifications and not shown on the drawings shall be considered as though it were covered by both specifications and drawings. Any points of disagreement should be referred to the City's representative as soon as possible to resolve any possible misunderstandings.

y. Clean Up: Upon completion of the work, the Contractor shall remove all rubbish and waste materials resulting from the Contractor's operations and leave the ground along the route of the pipeline in a neat and clean condition. The Contractor shall be responsible for removal of all excess spoil from the trench excavations, the City shall not accept any responsibility.

z. Guarantee of Workmanship: Notwithstanding Owner's acceptance of the new facilities, the Contractor shall guarantee all of his workmanship for a period of one (1) calendar year from and after acceptance of the work by the Owner. The Contractor shall repair and make good any defects or imperfections in the work at his sole cost and expense. If deficiencies develop during the guaranteed calendar year, such as but not limited to: leaks in the pipeline or appurtenances, settlement of trenches, or deteriorating pavement due to faulty or imperfect workmanship, the Owner retains the right of making repairs and the Contractor is responsible for the cost of said repairs.

TABLE 22.02 A

ALLOWABLE LEAKAGE PER 1000 FT. OF DUCTILE IRON PIPELINE

Average Test Pressure	Nominal Pipe Diameter							
	6"	8"	10"	12"	14"	16"	18"	24"
(PSI)	GALLONS PER HOUR (GPH) *							
200	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.55
175	0.59	0.80	0.99	1.19	1.39	1.59	1.79	2.38
150	0.55	0.74	0.92	1.10	1.29	1.47	1.66	2.20

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

TABLE 22.02 B

ALLOWABLE LEAKAGE PER 1000 FT. OF PVC C-900 PIPELINE			
Average Test Pressure	Nominal Pipe Diameter		
	6”	8”	12”
(PSI)	GALLONS PER HOUR (GPH) *		
200	0.57	0.76	1.15
150	0.50	0.66	0.99
* If the pipeline under test contains sections for various diameters, the allowable leakage will be the sum of the computed leakage for each size.			

22.03 DISINFECTION OF NEW MAINS

a. General Instructions:

Precautions shall be taken to prevent soiling of pipe, fittings and other materials. Pipe and fittings shall be stored so as not to accumulate mud or water, and other material shall be stored in a clean, dry location. Particular care shall be taken to keep rubber gaskets and pipe ends clean.

All pipe shall be clean before lowering the pipe into the trench.

When the main is left unattended, even for a short time, the ends shall be plugged to prevent the entrance of foreign material or small animals.

Loading of new mains: A reduced pressure principle (RPP) backflow assembly is required on all new main installations to prevent any chlorine used for disinfection from entering into domestic water supply. The backflow assembly must be tested by a certified backflow assembly tester within the last twelve (12) months. This test will be verified by the City’s Inspector. The backflow assembly can be placed on a blow off or fire hydrant. Backflow assemblies and annual testing will be supplied by, and be the responsibility of the installing Contractor.

Apply the chlorine, using one of the methods described under Section 22.03.b “Chlorine Application Methods” of these Standard Specifications. A City Inspector is to measure the chlorine concentration to insure that a fifty parts per million (50 ppm) concentration has been applied (not to exceed 200 ppm). Samples with a high chlorine concentration must be analyzed with a high range total chlorine test kit. Hach Catalog Number 2444400, or equivalent may be used to the initial dosage test.

Allow heavily chlorinated water to stand therein for a contact period of at least twenty-four (24) hours. If the water temperature is less than forty-one degrees Fahrenheit (41° F), the water shall remain in the pipe for at least forty-eight (48)

hours. A City Inspector is to measure the chlorine after this contact period. When using the tablet method, there must be a detectable free chlorine residual at the end of the required hold time. When using liquid chlorine, the free chlorine residual must be at least ten parts per million (10 ppm) at the end of the required hold time. If the concentration has dropped to less than ten parts per million (10 ppm), then the mains must be superchlorinated by the continuous feed method, and the required contact period shall be repeated due to the high chlorine demand. Equipment used to superchlorinate by the continuous feed method will be provided by the installing Contractor.

At the end of the contact period, flush the main thoroughly, refer to Section 22.04 "Dechlorination of Flushed Water". The City Inspector is to test for chlorine to demonstrate that the water leaving the main has no more chlorine than in the water entering the main.

The City's representative will collect two (2) sample sets at least twenty-four (24) hours apart and work with the Water Quality (WQ) Department in having them analyzed for coliforms and heterotrophic bacteria. The samples should be taken from a combination blow off and sampling device illustrated in the City of Visalia, Engineering Improvement Standards or a service located near the end of the chlorinated section. In accordance with the latest revision of AWWA standard C651 one (1) sample set (two samples 24 hours apart) shall be collected every one thousand two hundred feet (1,200'), and one (1) set from the end of the line and one set from each branch or dead-end.

A WQPM will review the bacteriological results and determine if the main can be put into service. Further flushing and analytical work will be necessary if the bacteriological tests are positive. If any follow-up sample tests positive, the main must be superchlorinated by the continuous feed method. Equipment used to superchlorinate by the continuous feed method will be provided by the installing Contractor. The main will only be put into service with two (2) consecutive sets of negative bacteriological results and a free chlorine residual between three-tenths of one part per million and one part per million (0.3 ppm - 1.0 ppm).

Before a tie-in is performed, the inside surface of all materials such as the tee, pipe nipples, couplings, and tapping sleeve must be swabbed with NSF-grade twelve and five tenths percent (12.5%) sodium hypochlorite (HTH) or heavily dusted with HTH granules.

b. Chlorine Application Methods:

Safety Notes: Chlorine tablets and solutions should be handled with care, as they are dangerous to the eyes, irritating to the skin, and will damage shoes and clothing. Minimize your exposure by reading and having the Material Safety Data Sheet (MSDS) available should an emergency occur. Follow the guidelines for protecting yourself, asking your supervisor when in doubt and by erring on the safe side by using respirators, protective clothing and other protective equipment.

i. Method No. 1 – Calcium Hypochlorite (HTH) Tablet Method

(a) This method works well for short jobs and for small diameter pipe of any kind. It cannot be used where trench water has entered the main. The main cannot be flushed prior to disinfection, so the method requires that the pipe be kept clean during laying.

(b) Use Permatex (Loctite) Form-A-Gasket No. 1 Sealant (Permatex (Loctite) Catalog No. 80001), to fasten the required number of HTH tablets (See Tables 22.03 A and 22.03 B) to the top of each length of pipe. HTH tablets may be oval or round, must be NSF approved, and have sixty-five percent (65%) free chlorine.

(c) Permatex (Loctite) No. 1 is a fast drying, hard-setting gasket sealant designed for sealing rigid materials and flanges, or patching holes and joints where permanent assembly is desired. Please refer to its MSDS for health and safety precautions in its use. Do not use Permatex (Loctite) No. 2, which is a slow-drying, non hardening sealant used where sealing is more important than adhesion. Tubes of Permatex (Loctite) No. 1 may be purchased locally at any auto parts store. The tablets may be fastened to the pipe before it is placed in the trench provided the top of pipe is marked to avoid the possibility that the pipe may be rotated.

(d) HTH tablets should be removed at the end of the day, when pipe is not installed in the ground the same day tablets are applied. Reuse those tablets in the following days if still intact. This is to prevent moisture from reducing the amount of chlorine available for disinfection.

(e) In addition to the tablets, place ten ounces (10 oz) of HTH granules at the upstream end of the first length of pipe into which water will flow. This will insure that heavily chlorinated water flows into crevasses caused by couplings and valves. For long runs, this should be repeated about five hundred feet (500').

(f) When using flexible couplings, apply NSF-grade sodium hypochlorite with a spray bottle method, or place additional HTH granules in the annular space between the coupling and the pipe.

(g) When installing CL&C pipe, one (1) cap full of HTH granules shall be placed in the pipe after the pressure test and before tie-ins. NSF-grade sodium hypochlorite can be used when main needs to be placed in service as soon as possible, and can be flushed to the system chlorine reading.

(h) Fill the pipe very slowly and proceed as outlined under Section 22.03.a "General Instructions".

TABLE 22.03 A
HTH Oval Tablet Method No. 1 of Main Chlorination
Number of Tables Specified for Disinfection of at least 50 ppm

Length of Section	DIAMETERS															
	4"		6"		8"		10"		12"		14"		16"		18"	
	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm
18'	1	95	2	84	3	71	4	61	5	52	7	54	9	53	11	51
20'	1	85	2	75	3	64	4	54	6	56	8	55	10	53	12	50
30'	1	56	2	50	4	57	6	54	8	50	11	51	15	53	18	50
40'	2	85	3	56	5	53	8	54	11	52	15	52	19	50	24	50

TABLE 22.03 B
HTH Round Tablet Method No. 1 of Main Chlorination
Number of Tablets Specified for Disinfection of at least 50 ppm

Length of Section	DIAMETERS															
	4"		6"		8"		10"		12"		14"		16"		18"	
	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm	# of tabs	ppm
18'	1	215	1	95	1	55	2	70	2	50	3	55	3	54	5	55
20'	1	200	1	85	1	50	2	60	3	65	4	65	5	60	6	60
30'	1	130	1	60	2	65	3	60	4	60	5	55	7	55	8	50
40'	1	100	2	85	3	75	4	60	5	55	7	55	9	55	11	55

ii. Method No. 2 - 12.5% Liquid Chlorine (Sodium Hypochlorite)

This method is general in scope and must be used when it is necessary to re-chlorinate an existing main. It may also be used on new mains, in which case place ten ounces (10 oz) of HTH granules at the upstream end of the first length of pipe into which water will flow, and every five hundred feet (500') thereafter.

This method consists of introducing a twelve and five-tenths percent (12.5%) chlorine solution into water which is being used to fill water main. The twelve and five-tenths o percent (12.5%) chlorine solution must be NSF approved and can be purchased through several vendors.

(a) Calculate the total volume (ounces or gallons) of twelve and five-tenths of one percent (12.5%) hypochlorite solution needed, based on the pipe diameter and section length (See *Table 22.03 C* and the example below

Table 22.03 C).

(b) Choose a suitable filling rate and determine the time required to fill the water main from *Table 22.03 D*.

(c) Calculate the twelve and five-tenths of one percent (12.5%) hypochlorite dose rate using the results from 1 and 2 above. Using the examples below *Table 22.03 C & Table 22.03 D*, the dose rate would be one and two-tenths gallons per fifty-two minutes (1.2 gal/52.0 min, or 150 oz/52.0 min) equals two-hundredths of one gallon per one minute (0.02 gal/min, or 3 oz/min).

(d) It is recommended to use a metering pump, a controlled vacuum device, or an equivalent device to introduce the twelve and five-tenths of one percent (12.5%) hypochlorite solution into the main at a constant rate. The feed device and method must be approved by the City prior to loading the main. Adjust the feed device to the dose rate. Introduce the solution through a corporation cock, blow off, or service connection at or ahead of the inlet end of the water main to be disinfected.

(e) After flushing the main thoroughly, adjust the filling rate by measuring the time required to fill a five gallon (5 gal) or other suitable container.

(f) Begin introducing the twelve and five-tenths of one percent (12.5%) hypochlorite solution into the main, and continue until a chlorine residual test on a sample taken from the discharge end of the main shows at least fifty parts per million (50 ppm) chlorine.

(g) Close the filling valve or blow off, and stop introducing hypochlorite solution. Disconnect and flush the feed device and equipment thoroughly with fresh water.

(h) Proceed as outlined under Section 22.03.a “General Instructions.”

TABLE 22.03 C
12.5% Liquid Hypochlorite Method of Main Chlorination
Amount of 12.5% Liquid Hypochlorite (ounces)
Specified for Disinfection of at least 50 ppm

Length of Section	DIAMETERS															
	4"		6"		8"		10"		12"		14"		16"		18"	
	oz.	ppm	oz.	ppm	oz.	ppm	oz.	ppm	oz.	ppm	oz.	ppm	oz.	ppm	oz.	ppm
18'	1	85	2	75	3	60	4	55	6	55	8	55	10	50	13	55
20'	1	75	2	65	3	55	5	60	6	50	9	55	11	50	14	50
30'	1	50	3	65	4	50	7	55	9	50	13	55	16	50	21	50
40'	2	75	3	50	6	55	9	55	12	50	17	50	22	50	27	50

Table 22.03 C is used to calculate the total ounces of 12.5% hypochlorite required to produce water with a free chlorine concentration of at least 50 ppm in the main.
For example: A 20 foot section of 8 inch pipe needs 3 ounces; so for 1000 feet (50-20 foot sections), 50 x 3 = 150 ounces. 150/128 ounces/gal. = 1.2 gal.

TABLE 22.03 D

	DIAMETER OF PIPE BEING DISINFECTED								
	4"	6"	8"	10"	12"	14"	16"	18"	20"
(GPM)	TIME REQUIRED TO FILL 100 FEET OF PIPE (MINUTES)								
10	6.5	14.7	26.1	40.8	58.8	---	---	---	---
20	3.3	7.3	13.0	20.4	29.4	---	---	---	---
35	1.9	4.2	7.5	11.7	16.8	---	---	---	---
50	---	2.9	5.2	8.2	11.8	15.0	20.9	---	---
75	---	2.0	3.5	5.5	7.9	10.7	14.0	---	---
100	---	---	2.6	4.1	5.9	8.0	10.4	13.2	16.3

Table 22.03 D is used to estimate the time required to fill the pipe with chlorinated water.
For example: A flow rate of 50 gpm will fill 1000 feet of 8 inch pipe in 10 x 5.2 = 52.0 minutes.

22.04 DECHLORINATION OF FLUSHED WATER

a. Safety Notes: While it is unlikely that these procedures will produce a hazardous reaction, employees should proceed with caution when working with calcium thiosulfate. Minimize your exposure by reading and having the MSDS available should an emergency occur. Follow the guidelines for protecting yourself, asking your supervisor when in doubt and by erring on the safe side by using respirators,

protective clothing and other personal protective equipment.

i. The discharge/disposal of all chlorinated water generated from the procedures in Section 22.03 "Disinfection of New Mains" shall be the Contractor's responsibility. The Contractor shall comply with all federal, state and local discharge/disposal requirements for chlorinated water.

ii. If dechlorination of the water is required, then the chlorinated water that is discharged to a storm drain shall be dechlorinated by water industry accepted methods. The dechlorinated water will be tested for chlorine residual to verify that no detectable amount of free chlorine is present. This testing will take place from the onset of discharging the water and at frequent intervals throughout the dewatering of the pipe. No discharge to an open stream (waters of the State or waters of the U.S.) will be allowed without a National Pollutant Discharge Elimination System (NPDES) Permit.

iii. Determine the chlorine concentration of the water to be flushed. If the water to be flushed contains a detectable level of chlorine, then that water must be dechlorinated as follows:

Please note: The use of the dechlorinating agent Captor (30% calcium thiosulfate) is recommended by the City. Calcium thiosulfate is less hazardous than other chemicals, and will not deoxygenate the water when marginally over-applied. Gross over-application of any dechlorinating agent is unacceptable because of its potential to deoxygenate a receiving water body. THE USE OF ANOTHER DECHLORINATING AGENT MUST BE APPROVED BY THE CITY.

b. Prepare a Captor solution for water containing the following chlorine residuals:

i. Less than one milligram per one liter (<1 mg/L): add two (2) cups of Captor to twenty-five gallons (25 gal) of water. This will dechlorinate twenty-five thousand gallons (25,000 gal) of water with a chlorine residual of one milligram per one liter (1mg/L) or less.

ii. One milligram per one liter to fifty or more milligrams per one liter (1mg/L - 50+ mg/L): Use straight thirty percent (30%) Captor solution.

c. Calculate the volume of the new main in gallons as follows:

Pipe Length		Pipe Diameter		Pipe Diameter					Total
_____ ft	X	_____ ft	X	_____ ft	X	0.785	X	7.48g/ft³	= ____ gals

d. Calculate the volume of the thirty percent (30%) Captor needed to dechlorinate one milligram per one liter to fifty milligrams per one liter (1 mg/L - 50 mg/L) chlorine residuals for the volume calculated above:

Pipe Volume		Chlorine Concentration (1-50)				Captor		Total
_____ gal	X	_____ mg/L	X	1.45	/	300,000 mg/L	=	____ gals

e. Application of dechlorinating solution:

i. Elevate the dechlorinating solution container by placing it on a truck. Run a length of clear one-fourth of one inch outside diameter (¼" O.D.) polyethylene tubing from the container on the truck to a petcock (True Value Hardware part #776674) mounted on a blow off or hydrant pipe. When the water flow starts, a venturi will be created to siphon the calcium thiosulfate from the container and into the main flowstream. The feed rate of the diluted solution can be adjusted by opening or closing the one-fourth of one inch (¼") in-line valve (True Value Hardware part #467639) on the one-fourth of one inch (¼") tubing.

ii. Check the chlorine residual at the storm drain inlet. If there is a chlorine residual, slowly increase the feed rate of the Captor solution until you can no longer detect chlorine. If there is no chlorine residual at the storm drain inlet, make sure that the Captor solution is not being grossly over applied by slowly decreasing the feed rate until chlorine is detected. Then slowly increase the feed rate again until no chlorine is detected.

iii. Best Management Practices must be used when discharging water into a storm drain. This discharge uses the Developer's NPDES Permits. No sediments shall be allowed to be discharged into a storm drain.

iv. The installing Contractor shall follow the water quality objectives stated below.

(a) pH = 6.5 to 8.5

(b) Chlorine = none detected

(c) Concentration of total suspended solids is less than twenty-five milligrams per one liter (<25 mg/L).

v. If you find that the water naturally dechlorinates itself by the time it reaches the storm drain inlet, there is no need to add the Captor solution.