CITY OF CLOVIS

STANDARD SPECIFICATIONS

October 1, 2012

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STANDARD SPECIFICATIONS
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GENERAL PROVISIONS

SECTION 1 - DEFINITIONS AND TERMS

1-1 General

Unless the context otherwise requires, wherever in these Standard Specifications and other contract documents the following terms, or pronouns in place of them, are used, the intent and meaning shall be interpreted as provided in this Section 1.

Reference to a particular section in these Standard Specifications is made by section number without denoting "of these Standard Specifications." Reference to standard specifications or standards of other agencies or organizations is so noted. See Section 4-8, "Incorporation of Referenced Specifications."

Where used in these Standard Specifications or any referenced Specifications, the following abbreviations shall have the titles affixed thereto in the table below.

AAN	American Association of Nurserymen.
AASHTO	American Association of State Highway and Transportation Officials.
AISC	American Institute of Steel Construction.
AISI	American Iron and Steel Institute.
ANSI	American National Standards Institute.
APHA	American Public Health Association.
API	American Petroleum Institute.
AREMA	American Railway Engineering and Maintenance-of-Way Association.
ASME	American Society of Mechanical Engineers.
ASTM	American Society for Testing and Materials.
AWG	American Wire Gage.
AWPA	American Wood-Preservers' Association.
AWS	American Welding Society.
AWWA	American Water Works Association.
EIA	Electronic Industries Association.
IEEE	Institute of Electrical and Electronics Engineers.
NEMA	National Electrical Manufacturers Association.
UL	Underwriters' Laboratories Inc.

1-2 Acceptance

The formal acceptance by the City Council of an entire contract, which has been completed in all parts and requirements in accordance with the Plans and Specifications and any modifications thereof, previously approved. The "Notice of Completion" shall mean the document recorded with the Fresno County Recorder indicating the formal acceptance of a specified Contract.

1-3 Base

A layer of specified material of planned thickness placed immediately below the pavement or surfacing.

1-4 Basement Material

The material in excavation or embankments underlying the lowest layer of subbase, base, pavement, surfacing or other specified layer which is to be placed. See Section 1-44, "Subgrade."

1-5 Bidder
Any individual, firm, partnership, corporation, or combination thereof, submitting a proposal for the work contemplated, acting directly or through a duly authorized representative.

1-6 California Manual On Uniform Traffic Control Devices (California MUTCD)
The most current adopted version of The California Manual on Uniform Traffic Control Devices for streets and highways, and amendments thereto. Supersedes the MUTCD and MUTCD California Supplement.

1-7 City (Owner)
The City of Clovis, California, acting as a municipal corporation and/or a trustee for improvement districts within the City. The term "Owner" and "City" shall have the same meaning.

1-8 Completion
A. For purposes of a Notice of Completion and Civil Code sections 3082-3106 and 3179-3214, "completion" means the date of acceptance of the Work as complete by the City Council, pursuant to Civil Code section 3086.

B. For purposes of retention release under Public Contract Code section 7107, "completion" means any of the following:
   1. The occupation, beneficial use, and enjoyment of a work of improvement, excluding any operation only for testing, startup, or commissioning, by the public agency, or its agent, accompanied by cessation of labor on the work of improvement.
   2. The acceptance by the public agency, or its agent, of the work of improvement.
   3. After the commencement of a work of improvement, a cessation of labor on the work of improvement for a continuous period of 100 days or more, due to factors beyond the control of the contractor.
   4. After the commencement of a work of improvement, a cessation of labor on the work of improvement for a continuous period of 30 days or more, if the public agency files for record a notice of cessation or a notice of completion.

C. For all other purposes (including but not limited to assessment of liquidated damages), "completion" means the point where Contractor has fully and correctly performed all Work in all parts and requirements, a Final Inspection has been made, all corrective and punch list Work has been performed, and the Engineer has certified that the Work is ready for acceptance by the City Council. "Completion" does not mean substantial completion or any other form of partial or insufficient performance of the Work

1-9 Contract
The written agreement covering the performance of the work and the furnishing of labor, materials, tools and equipment in the construction of the work. The Contract shall include the Agreement, Notice Inviting Bids, Proposal, Plans, these Standard Specifications, the Contract Specifications, Contract Bonds, Permits, any and all supplemental agreements amending or extending the work contemplated and which may be required to complete the work in a substantial and acceptable manner. Supplemental agreements are written agreements covering alterations, amendments or extensions to the contract and include contract change orders.

1-10 Contract Specifications
The booklet containing the Notice Inviting Bids, Proposal Form, Reference to Standard Specifications, Special Provisions, Technical Provisions (where used), Proposal Requirements and Conditions, Description of Bid Items, Appendices, and any other documents which may be added to the booklet.

1-11 Contractor
The person or persons, firm, partnership, corporation, or combination thereof, private or municipal, who have entered into a contract with the City, as party or parties of the second part or their legal representatives.

1-12 Days
Unless otherwise specified in these Standard Specifications or the Contract Specifications, "days" mean calendar days.

1-13 Divided Roadway
A roadway with separated traveled ways for traffic, generally in opposite directions.

1-14 Encroachment
Any structure or object of any kind or character placed, without the authority of law, either in, under, or over any City right of way. An encroachment can include, but not be limited to, any tower, pole, pole line, pipe, pipeline, driveway, fence, stand, private roadway, billboard or sign.

Encroachments can also include special events conducted in or on City rights of way, such as street festivals, sidewalk sales, community-sponsored events or activities, or community-approved activities. See Section 1-28, "Permit."

1-15 Engineer
The City Engineer, acting either directly or through properly authorized agents, the agents acting within the scope of the particular duties delegated to them.

1-16 Engineer's Estimate
The list of estimated quantities of work to be performed as contained in the Proposal Form.

1-17 Extra Work
Any obligations, construction, or service outside the scope of the contract.

1-18 Finish Grade
The elevation or slope shown on the plans assigned to the design finished surface of an improvement, including earthwork which will receive no paving or other surfacing, after all work on the improvement has been completed.

1-19 Grading Plane
The surface of the basement material (subgrade) upon which the lowest layer of subbase, base, pavement, surfacing or other specified layer is placed.

1-20 Inspector
A duly authorized agent of the Engineer.

1-21 Laboratory
Established commercial laboratories authorized by the City to test materials and work involved in the contract.

1-22 Legal Holidays
Those days designated as City holidays as designated by the Clovis City Council in observance of which City offices are closed.

1-23 Line and Grade
The term used to describe the horizontal and vertical lines, elevations and slopes shown on the plans to which all improvements and earthwork are to be constructed.

1-24 Liquidated Damages
The amount prescribed in the Contract Specifications to be paid to the City or to be deducted from any payments due or to become due the Contractor for each day's delay in completing the whole or any specified portion of the work beyond the time allowed in the Contract Specifications.

1-25 Manual On Uniform Traffic Control Devices - California
The most current adopted version of California Manual on Uniform Traffic Control Devices for streets and highways, and amendments thereto. Supersedes the MUTCD and MUTCD California Supplement.

1-26 Median
That portion of a divided roadway separating the traveled ways for traffic in opposite directions including inside shoulders, if any. Medians may be raised or un-raised, paved or unpaved.

1-27 Pavement
The uppermost layer of material placed on the traveled way or shoulders. This term is used interchangeably with surfacing.

1-28 Permit
As used in these Standard Specifications, the document issued by a jurisdictional agency specifying the terms and conditions under which the permittee is authorized to perform certain work typically associated with a Contract awarded by the City. Permits may be issued by one or more agencies which have jurisdiction by law or by ownership over various aspects of the work. Permits may take the form of providing authorization to perform general roadwork, to install, construct, or repair certain encroachments, or govern such things as air pollution and storm water pollution prevention. The term "Encroachment Permit" describes the permit issued by the City Engineering Division and does not apply to Building Permits issued by the City Building Division. See Section 1-14, "Encroachment."

1-29 Permittee
The person or persons, partnership or corporation, private or public, who has obtained a permit from the City or other jurisdictional agency and who has agreed to do work encompassed by said permit in conformance with the requirements thereof.

1-30 Plans
The official Construction Plans which show the location, character, dimensions and details of the work to be performed. Standard Drawings (sometimes referred to as Standard Plans), profiles, typical cross sections, working drawings and supplemental drawings, or reproductions thereof, approved by the Engineer, are to be considered as a part of the Plans. As used in this definition, the term Standard Drawings refers to the City of Clovis Standard Drawings.

1-31 Proposal
The written offer of the bidder for the work when made out and submitted on the prescribed proposal form, properly signed and guaranteed.

1-32 Proposal Form
The approved document upon which the City requires formal bids be prepared and submitted for the work.

1-33 Proposal Guaranty
The cash, cashier's check, certified check or bidder's bond accompanying the proposal submitted by the bidder, as a guarantee that the bidder will enter into a contract with the City for the performance of the work if the contract is awarded to the bidder.

1-34 Right of Way
The whole right of way or area which is reserved for and secured for use in constructing the roadway and its appurtenances.

1-35 Roadbed
The roadbed is that area upon which a traveled surface will be installed, generally between curbs delineating the edges of the traveled way. The roadbed rises in elevation as each increment or layer of subbase, base, surfacing or pavement is placed.

1-36 Roadway
That portion of the right of way included between the outside lines of sidewalks, or curbs, slopes, ditches, or channels, including all the appertaining structures, and other features necessary to proper drainage and protection.

1-37 Shoulders
The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses. Shoulders may be paved or unpaved.

1-38 Special Provisions
The Special Provisions and other specifications included in them by virtue of reference. See Section 1-10, "Contract Specifications."

1-39 Specifications
Where used in these Standard Specifications, the term "Specifications" without modifier shall mean collectively these Standard Specifications and the Contract Specifications, embodying all the applicable specification documents therein.

1-40 Standard Drawings
The latest edition of the Standard Drawings of the City of Clovis.

1-41 Standard Specifications
These Standard Specifications and other specifications included in them by virtue of reference.

1-42 State
The State of California Department of Transportation. This term is used interchangeably with Caltrans and has the same meaning.

1-43 Subbase
A layer of specified material of planned thickness between a base and the basement material.

1-44 Subgrade
That portion of the roadbed on which pavement, surfacing, base, subbase, or a layer of any other material is placed. See Section 1-4, “Basement Material.”

1-45 Surety
"Surety" or "Corporate Surety" refers to a corporate surety company included on the State of California, Department of Insurance, Admitted Sureties List, most current edition, and acceptable to the City.

1-46 Surfacing
The uppermost layer of material placed on the traveled way, or shoulders. This term is used interchangeably with pavement.

1-47 Traffic Lane
The portion of a traveled way for the movement of a single line of vehicles.

1-48 Traveled Way
The portion of the roadway for the movement of vehicles, generally between faces of curbs.

1-49 Work
All the obligations and construction specified, indicated, shown, required or contemplated in the Contract and Contract Documents, including all alterations, amendments or extensions thereto made by Contract Change Order or other written orders of the Engineer, and including all punch list, corrective work, as-built or as-constructed drawings, and manuals at the end of the construction. The Work shall constitute “work” and “work of improvement” under Civil Code sections 3082-3106, and a “work of improvement” shall not include work being performed by the Owner (by itself or through other contractors) that is merely related to the Work

SECTION 2 - PROPOSAL REQUIREMENTS AND CONDITIONS

2-1 General

The City Clerk will receive at City Hall, 1033 Fifth Street, Clovis, California, 93612, prior to the hour and day specified in the "Notice Inviting Bids", sealed proposals for furnishing material, supplies, equipment and labor for performing the work as specified in the Plans, these Specifications, and the Contract Specifications. Proposals submitted at or after the hour specified for receipt of bids will be returned unopened.

2-2 Examination Of Site Of Work, Plans, Specifications And Contract Documents

The bidder is required to carefully examine the site of the proposed work, the Plans and Specifications for the work contemplated. Bid submission shows the bidder has investigated the site and is satisfied as to the conditions to be encountered and the scope of work, and understands the requirements of the Plans and Specifications.

Prospective bidders must satisfy themselves, by such means as they prefer, as to local conditions and all other matters which influence their bid for the work. The City or Engineer shall not be liable on account of any obstructions of any nature, unforeseen difficulties in construction, or unreliable information from any source.

2-3 Form Of Proposal

All proposals must be made upon blank forms to be obtained from the office of the City Engineer, 1033 Fifth Street, Clovis, California, 93612. All proposals must give the unit price where indicated, or lump sum where unit prices are not called for, for each of the items. Proposals are to be filled out completely and must be signed by the bidder, all as indicated on the proposal form. The Bid Proposal Form includes the following documents, all of which are to be completed in all respects and submitted as a complete package: Bid Proposal, Bid Summary, Bidder's Information, Subcontractors List, Noncollusion Declaration, and Bid Security. Depending on the nature of the project, other documents may be included by the City and shall be completed in all respects and submitted by the bidder with the Bid Proposal Form or as otherwise indicated by the City. All proposals must be submitted under sealed cover.

2-4 Quantities

The estimates of the quantities of work to be performed and materials to be furnished given in the Notice Inviting Bids, Bid Proposal and in the Contract Specifications are approximate only, being given as a basis for the comparison of bids. The City does not expressly or by implication agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or portion of the work or to omit portions of the work that may be deemed necessary or expedient by the City Engineer. Reference is made to Section 4-10, "Changes," regarding changes to quantities.

2-5 Unit Or Lump Sum Prices

The unit or lump sum prices inserted in the bid form by the bidder will be considered to be the bid prices for the various bid items of work performed. In case of a discrepancy between the unit price bid and the calculated total for any bid item, the unit price shall govern. In case of a discrepancy between the unit or lump sum price in words and figures provided on the Bid Proposal, the lump sum or unit price quoted in words shall prevail.

2-6 Proposal Guaranty
All proposals must be accompanied by either a cashier's check, certified check or bidder's bond of a corporate surety in a sum equal to at least 10 percent of the total amount of the bid. Checks or bonds must be payable to the City of Clovis. Corporate Sureties must comply with the definition in Section 1-45, "Surety." Such securities will be retained by the City as a guarantee that the bidder, if the bidder's bid is accepted, will enter into a satisfactory Contract twelve (12) calendar days from the date notice of award is mailed to the bidder, and will furnish good and sufficient bonds for the faithful performance thereof and for the payment of labor and material costs in accordance with the requirements of Section 3-3, "Required Contract Securities, Insurance Certificate, Business License, Injury and Illness Prevention Plan."

2-7 Designation Of Subcontractors
The Contractor shall comply with the California Subletting and Subcontracting Fair Practices Act, commencing with Section 4100 of the State Public Contract Code. The Contractor shall file with the bid the name and address of each subcontractor who will perform more than one-half of one percent (½ %) of the contract amount, or in the case of a project designated by the City as a Street Project, one half of one percent of the contract amount or ten thousand dollars ($10,000), whichever is greater. To determine the value of work subcontracted, where an entire item is subcontracted, the value of work subcontracted will be based on the contract item bid price. When a portion of an item is subcontracted, the value of work subcontracted will be based on the estimated percentage of the contract item bid price, determined from information submitted by the Contractor, subject to approval by the Engineer.

Only one subcontractor shall be listed for each portion of the work. The portion shall be defined as to its nature and extent. The failure of the Contractor to specify a subcontractor constitutes a statement that the Contractor is qualified and intends to perform said work.

Designation of subcontractors must be made upon forms included with the bid package or to be obtained from the office of the City Engineer at City Hall. The bidder must give the names of all the subcontractors and the form must be signed by the bidder.

The Contractor must have the consent of the City and approval of the City Engineer, in writing, to substitute a subcontractor other than that designated in the original bid, to permit any subcontract to be assigned or transferred, to allow a subcontract to be performed by other than the original subcontractor, or to subcontract work for which no subcontractor was designated in the original bid and which is more than one-half of one percent (½ %) of the contract amount, or in the case of a City-designated Street Project, one half of one percent or ten thousand dollars ($10,000), whichever is greater.

Violation of any of the above provisions is a violation of the Contract and cause for ordering any unapproved subcontractor from the work site. The Contractor shall comply with Section 8-3, "Subcontracting," which contains additional regulations regarding subcontractors.

2-8 Withdrawal Of Proposals
Any bid may be withdrawn at any time prior to the time fixed in the public notice for the opening of bids, but only upon filing with the City Clerk a written request of the withdrawal. The bidder, or the bidder's duly authorized representative, shall execute the request. The withdrawal of a bid does not prejudice the right of the bidder to file a new bid. A bid will not be received, and no bid may be withdrawn after the time fixed in the Notice Inviting Bids for the opening of bids.

2-9 Relief Of Bidders

The provisions of Public Contract Code Sections 5100 to 5107, inclusive, applies to all Contracts. If the bidder claims a mistake was made in the bid presented, the bidder shall give the Engineer written notice within 5 days after the opening of the bids of the alleged mistake, specifying in the notice in detail how the mistake occurred.

2-10 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. The City may reject all bids for budgetary reasons.

More than one proposal from an individual, a firm or partnership, a corporation or an association under the same or different names, will not be considered. Reasonable grounds for believing that any bidder is interested in more than one proposal for the work contemplated may cause the rejection of all proposals in which such bidder is interested.

SECTION 3 - AWARD AND EXECUTION OF CONTRACT

3-1 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. For projects with no alternates, the award shall be determined by comparing the base bids. When alternative bids are included in the bid proposal, the award shall be determined by comparing the lowest totals of the base bid plus the bids of those alternatives specifically identified in the bid proposal to be used for the purpose of determining the lowest bid. The City reserves the right to add or subtract any of the alternatives after the lowest bid has been determined.

The award, if made, will be made within forty-five (45) calendar 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; the award, if made, will be made within sixty (60) calendar days after the opening of the proposals. If the second lowest responsible bidder refuses or fails to execute the Contract, the City may award the Contract to the third lowest responsible bidder; the award, if made, will be made within seventy-five (75) calendar days after the opening of the proposals. The periods of time specified above within which the award of a Contract may be made will be subject to extension for further periods agreed upon in writing between the City and the bidder concerned.

All bids will be compared on the basis of the Engineer's Estimate of quantities of work to be done as shown in the bid proposal. Bids shall be submitted on base bids and all alternate bids, if any, in order to be considered responsive.

3-2 Execution Of Contract

The Contract shall be signed by an authorized representative of the successful bidder and returned within twelve (12) calendar days after the bidder has received notice that the Contract has been awarded. No proposal shall be considered binding upon the City until execution of the Contract by all parties, including the City.

Failure to execute and submit the Contract within (12) calendar days after the bidder has received notice that the Contract has been awarded, shall be just cause for the annulment by the City of the award and the forfeiture of the proposal guarantee as liquidated damages. The Contractor shall submit to the Engineer along with the executed Contract, the documents required in Section 3-3, "Required Contract Securities, Insurance Certificate, Business License, Injury and Illness Prevention Plan," and Section 7-4, "Contractor's Insurance Requirements and Hold Harmless."

3-3 Required Contract Securities, Insurance Certificate, Business License, Injury And Illness Prevention Plan

The bidder to whom the Contract has been awarded will be required to furnish a Labor and Material Bond equal to one hundred percent (100 %) of the Contract price, and a Faithful Performance Bond equal to one hundred percent (100%) of the Contract price. Said bonds shall be secured from a corporate surety, and are to be submitted to the City Engineer with the executed Contract. Corporate Sureties are to comply with the definition in Section 1-45, "Surety."

In addition to furnishing the above required sureties, the bidder to whom a contract has been awarded shall furnish and submit with the executed contract an original Insurance Certificate indicating coverage in compliance with Section 7-4, "Contractor's Insurance Requirements and Hold Harmless."

The Contractor shall comply with Section 7-10, "Permits and Licenses." The Contractor to whom the contract is awarded, and all Subcontractors listed on the Contractor's Bid Proposal, or any Subcontractor substituted or added after a contract is awarded and in accordance with these Specifications, must obtain a City of Clovis Business License and pay all fees associated therewith. Business Licenses are to be obtained from the City of Clovis Finance Department, 1033 Fifth Street, Clovis, CA 93612. Bidders must contact the Finance Department to determine fee amounts prior to submitting a bid. This requirement applies regardless of the business address or location of the Contractor or any Subcontractor. Evidence showing the Contractor and all subcontractors have obtained a City of Clovis Business License shall be submitted to the Engineer with the executed Contract.

In compliance with Section 7-12 "Safety Provisions; First Aid; Injury and Illness Prevention Plan," the Contractor shall submit with the above documents a copy of the Contractor's Injury and Illness Prevention Plan.

3-4 Return Of Proposal Guaranties

All proposal guaranties will be held until the Contract has been awarded, after which the guaranties accompanying proposals no longer considered in making the award will be returned to the bidder whose proposal they accompanied. Retained proposal guaranties will be held until the Contract has been executed, after which all guaranties will be returned, except those forfeited as required in Section 3-2, "Execution of Contract."

3-5 Material Statement, Samples, And Guarantees

As permitted in Section 6, "Control of Materials," before any Contract is awarded, the bidder may be required to furnish a complete statement of the origin, composition, and manufacturer of any or all materials to be used in the construction of the work together with samples which may be subjected to the tests provided for in these Specifications to determine their quality and fitness for the work.

In compliance with Sections 5-23, "Guarantee of Workmanship," 6-10, "Guarantee of Materials," and 7-23, "Guarantee," the Contractor is required to guarantee all materials, equipment and workmanship for a period of one year from the date of Acceptance as denoted in Section 8-14, "Acceptance of Contract." In addition to the overall guarantee, the bidder may also be required by the Contract Specifications to furnish a written or other form of guaranty such as a bond covering certain items of work for varying periods of time from the date of recordation of said Notice of Acceptance. When the guaranty is required, the form and the time limit of the guaranty shall be as specified in the Contract Specifications. The signed written guaranty or the bond, whichever is required by the Contract Specifications, shall be delivered to the Engineer before Acceptance of the Contract.

All costs for compliance with this Section 3-5 shall be included in the various bid items; no additional payment will be made therefor.

SECTION 4 - SCOPE OF WORK

4-1 Intent Of Plans And Specifications

The intent of the Plans and Specifications is to prescribe the details for the construction and completion of the work which the Contractor undertakes to perform in accordance with the terms of the contract. Where the Plans or Specifications describe portions of the work in general terms, but not in complete detail, it is understood that only the best general practice is to prevail and that only materials and workmanship of the first quality are to be used. The Contractor shall furnish all labor, materials, tools, equipment, and incidentals, and do all the work involved in completing all of the contract requirements in a satisfactory and workmanlike manner.

The Plans, Specifications and other Contract documents will govern the work. Anything in the Specifications and not on the Plans, or on the Plans and not in the Specifications, shall be as though shown or mentioned in both.

The Contractor shall keep at the worksite a copy of the Plans and Contract Specifications, to which the Engineer shall have access at all times.

While it is believed that much of the information pertaining to physical conditions which may affect the cost of the proposed work will be shown on the Plans or indicated in the Contract Specifications, the City does not warrant the completeness or accuracy of such information. The Contractor shall ascertain the existence of any such conditions affecting the cost of the work which would have been disclosed by reasonable examination of the site.

No test, investigation, statement or estimate of a factual situation not incorporated in the Contract Documents shall be relied on by the Contractor. Any test, investigation, statement, or estimate of fact incorporated in the Contract shall be considered by the Contractor to be a suggestion only and he shall request equal access to the underlying or background informative material or source and shall arrive at his own opinion thereon, including his determination of how reliable might be any conclusion appearing in or inferred from the Contract Documents.

In general, the drawings will indicate dimensions, position and kind of construction, and the written Specifications will indicate qualities and methods. Any work indicated on the Plans and not mentioned in the written Contract Specifications, or vice versa, shall be furnished by the Contractor as though fully set forth in both. Work not particularly detailed, marked or specified, shall be as similar parts that are detailed, marked or specified.

All alterations authorized by the Engineer which affect the requirements and information given on the approved plans shall be in writing. No changes shall be made in any plan or drawing after the same has been approved by the Engineer, except by direction of the Engineer.

During the course of the work, if the Contractor discovers any discrepancies between the Plans and the conditions in the field, or any errors or omissions on the Plans or in the Specifications which will significantly affect the work, it shall be the Contractor's duty to inform the Engineer immediately in writing, and the Engineer shall promptly verify the same. Any work done after such discovery, until authorized, will be done at the Contractor's risk.

4-2 Coordination, Interpretation, And Precedence Of Plans And Specifications

The Plans, Specifications, 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 a complete work.

Whenever any conflict appears in any portions of the Contract, it shall be resolved by application of the order of precedence given below, unless the Engineer shall order otherwise.

1. Change Orders and Supplemental Agreements;
2. Agreement;
3. Pre-bid Addenda;
4. Contract Specifications;
5. Contract Construction Plans or Drawings;
6. City Standard Specifications (including General Provisions);
7. City Standard Drawings;
8. Any other referenced and incorporated specifications;
9. Any other referenced and incorporated plans or drawings.

Detailed plans and specifications shall take precedence over general plans and specifications, even within the same level of precedence. Dimensions called out on the Plans shall control and supersede scaled dimensions. No scaled dimension shall be used in the execution of the work, unless no dimension is called out on the Plans and the use of a scaled dimension is authorized by the Engineer.

4-3 Interpretations

Should it appear that the work to be done, or any matter relative thereto, is not sufficiently detailed or explained on the Plans or Specifications, 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 Plans and Specifications. In the event of doubt or question relative to the true meaning of these documents, reference shall be made to the Engineer, whose decision thereon shall be final.

4-4 Working Drawings

When working drawings or shop drawings are required by the Plans or Specifications, or requested by the Engineer, they shall be prepared in accordance with modern engineering practice by the Contractor at the Contractor's expense. Shop or working drawings shall be of a size and scale to clearly show all necessary details. Unless otherwise specified, shop or working drawings shall be submitted in quadruplicate to the Engineer for approval or correction at least fifteen (15) calendar days before approved drawings will be required for the work. If corrections are required, the Contractor shall make corrections as directed by the Engineer and shall deliver four (4) copies of the corrected shop or working drawings to the Engineer. Upon final approval, one set will be returned to the Contractor marked "approved" or "approved as corrected". For items requiring shop drawings, no materials shall be furnished or work done before approval of the drawings.

Approval of shop or working drawings by the Engineer means that there is substantial and acceptable conformance with the Plans and Specifications, but details of design may not necessarily be checked for adequacy or accuracy. An approval shall not relieve the Contractor from the responsibility for errors or omissions in the drawings or from deviations from the Contract documents unless such errors, omissions, or deviations were specifically called to the attention of the Engineer in writing. The Contractor is responsible for the correctness of the shop or working drawings, for shop fits and field connections, and for the results obtained by use of such plans.

In the event of discrepancy between the scaled dimension on any drawing and the figures written thereon, the figures shall be taken as correct, unless otherwise determined by the Engineer.

4-5 Conformity With Plans And Allowable Deviations

Finished surfaces including the completed final surface of earth, concrete, pavement or other material, or the completed top of a layer of subgrade, base or surfacing, in all cases shall conform with the lines, grades, cross sections, and dimensions shown on the Plans. Where tolerances are indicated in

the Specifications, the work shall be constructed within the tolerances. Deviations from the Plans required by the exigencies of construction will be determined in all cases by the Engineer and authorized only in writing.

4-6 Existing Facilities And Structures Shown On Plans

Where underground and surface facilities or structures are shown on the Plans, the locations, depth and dimensions of such facilities or structures are believed to be reasonably correct, but are not guaranteed. Such facilities or structures are shown for the information of the Contractor, but information so given is not to be construed as a representation that such facilities or structures will, in all cases, be found or encountered just where shown, or that they represent all the structures which may be encountered. The Contractor shall comply with the provisions in Section 8-15, "Utility and Non-Street Facilities; Potholing."

4-7 Omissions In Plans And Specifications

Omissions from the Plans or the Specifications of the materials or details of work which are manifestly or obviously necessary to carry out the intent of the Plans and Specifications, or which are customarily furnished or performed, shall not relieve the Contractor of the 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 Plans or Specifications.

Any materials or work mentioned in the Specifications and not shown on the Plans, or shown on the Plans and not mentioned in the Specifications, shall be of the same effect as if shown or mentioned in all.

4-8 Incorporation Of Referenced Specifications

Where referenced thereto on the Plans or the Specifications, the work embraced herein shall be done in accordance with the provisions of the "State of California, Department of Transportation Standard Specifications," latest revision, which Specifications are hereinafter referred to as the State Standard Specifications, and the Fresno Metropolitan Flood Control District Standard Specifications, latest revision, hereinafter referred to as the FMFCD Standard Specifications, in accordance with the following provisions.

In case of a conflict between the City's Standard Specifications and any other referenced and/or incorporated set of specifications such as the State or FMFCD Standard Specifications, the City's Standard Specifications take precedence over and shall be used in lieu of such conflicting portions in the other specifications, in accordance with Section 4-2, "Coordination, Interpretation, and Precedence of Plans and Specifications."

4-9 Work To Be Done

The work to be performed under the 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 contract documents in a satisfactory and workmanlike manner. The Work includes all work, material and services not expressly called for in the Contract Specifications or not shown on the Plans, but which may be necessary for completion and proper construction to carry out the Contract in good faith. The site of Work shall be left in a neat condition. The cost of all Work performed, furnished and installed is to be included in the amount bid for the various items of Work with no separate compensation allowed therefor.

4-10 Changes
The City reserves the right to make such alterations, deviations, additions to, or deletions from the plans and specifications, including the right to increase or decrease the quantity of any item or portion of the Work or to delete any item or portion of the Work (see Section 2-4, "Quantities") as may be deemed by the Engineer to be necessary or advisable, and to require such Extra Work as may be determined by the Engineer to be required for the proper completion or construction of the whole work contemplated. No adjustment will be made in the contract unit price of any contract item as a result of quantity changes, regardless of the amount of the increase or decrease, including deletion, of any item. Other changes required by the Engineer will be made in accordance with Section 4-1.03, "Changes," of the State Standard Specifications. In said Section 4-1.03, reference to Section 8-1.07 shall mean Section 8, "Progress and Prosecution," of these Standard Specifications; and reference to Section 9-1.03 shall mean Section 9-1.03 of the State Standard Specifications. For all changes, the City shall reasonably compensate Contractor with money (including overhead and profit) and/or time for any Extra Work ordered by the City to be performed; and the City shall receive a reasonable credit for money (including overhead and profit) and/or time saved by any deletion of work.

4-11 Extra Work
The Contractor shall be compensated for Extra Work. In the event portions of such work are determined by the Engineer to be covered by some of the various items for which there is a bid price or combinations of such items, the remaining portion of such work will be classed as Extra Work. Extra Work also includes work specifically designated as Extra Work in the Plans, Specifications or the Contract Specifications.

Unless otherwise specifically indicated in the Plans or the Specifications, any work or responsibility of the Contractor set forth in the Specifications or on the Plans and not set forth as a separate bid item shall be considered incidental or appurtenant to the work and full compensation for the cost thereof included in the various bid items of work. Such work or responsibility will in no case be considered as Extra Work.

When work is classified as Extra Work by the Engineer, the Contractor shall do such Extra Work and furnish labor, materials, and equipment therefor upon receipt of an approved Contract Change Order or other written order of the Engineer, and in the absence of such approved Contract Change Order or other written order of the Engineer, the Contractor shall not be entitled to payment for such Extra Work.

Extra Work, when ordered and accepted, shall be paid for in accordance with the terms of this Section 4-11 and Section 9-5, "Payment For Extra Work."

4-12 Notices, Change Orders, And Claims
If the Contractor requests additional compensation, whether money or time, or otherwise believes that it is entitled to a modification of the Contract terms and conditions, then Contractor shall follow the procedures for pursuing such requests specified in the Contract, otherwise Contractor shall have waived its rights to such pursuit and any later attempts to recover such compensation or modification shall be barred.

4-12.1 Definition Of "Claim"
A "Claim" is a separate demand by the Contractor for (a) a time extension, (b) payment of money or damages arising from work done by, or on behalf of, the Contractor, payment of which is not otherwise expressly provided for or the claimant is not otherwise entitled to, or (c) an amount the payment of which is disputed by the local agency. However, a "Claim" does not include a proposed change order submitted pursuant to these provisions since a proposed change order is a less formal procedure that is preliminary to a Claim. In addition, a "Claim" does not include vouchers, invoices,

progress payment applications, or other routine or authorized forms of requests for progress payments on the Contract. The responsibility to substantiate Claims shall rest with the Contractor.

4-12.2 Notice Requirements

Written notices of potential extra work, potential delay, and/or potential Claims based on Extra Work or delay, shall be submitted to City by Contractor within seven (7) days of becoming aware of the facts and/or issue creating such potential for Extra Work, delay or Claim, unless such facts and/or issue are, or may soon be, affecting the costs or critical path of the Work, in which case the written notice(s) shall be submitted immediately so the City may take immediate action to mitigate cost and schedule impacts for the Work. The written notice shall explain the nature of the potential Extra Work, delay or Claim so the City may take such action, if necessary. Failure to timely submit a written notice of potential Extra Work, delay and/or Claim shall act as a waiver by Contractor of any right to later submit a proposed change order or pursue a Claim on that issue. Contractor acknowledges that these written notices are critical to the Owner's management of the project and the mitigation of project costs and scheduling.

4-12.3 Proposed Change Orders

If Contractor disagrees with an approved change order issued pursuant to Section 4-10, "Changes," then Contractor shall submit a written protest pursuant to said Section 4-10 (including but not limited to Section 4-1.03, "Changes," of the State Standard Specifications).

If Contractor otherwise believes that it is entitled to additional compensation for money and/or time (including but not limited to grant of a time extension; payment of money or damages arising from work done by, or on behalf of, the Contractor, payment of which is not otherwise expressly provided for or the claimant is not otherwise entitled to; or an amount the payment of which is disputed by the local agency), then Contractor shall submit a proposed change order within twenty (20) days of (i) becoming aware of the potential right to additional compensation, or (ii) the date by which it should have become aware of the potential right to additional compensation. Failure to timely submit a proposed change order shall act as a waiver by Contractor of any right to later submit a proposed change order or Claim on that issue. The proposed change order shall indicate the grounds for the additional compensation (money and/or time) requested and the amount of compensation (money and/or time) requested, and Contractor shall include all information supporting the proposed change order. The City may accept the proposed change order, reject it (in whole or in part), or request additional information. If City does not respond to the proposed change order within thirty (30) days, the proposed change order shall be deemed rejected in whole as of the thirtieth day. If the City requests additional information, then the Contractor shall submit it within fifteen (15) days and the City shall have fifteen (15) days after such submission to accept or reject (in part) the proposed change order. If the City fails to respond within fifteen (15) days after such submission of additional information, then the proposed change order shall be deemed rejected in whole as of the fifteenth day.

Any written protest to an approved change order (see Section 4-10, "Changes," of these Standard Specifications and Section 4-1.03A, "Procedures and Protest," of the State Standard Specifications) and any proposed change order (see previous paragraph) shall be certified, pursuant to Section 4-12.5, "Content of Claim."

4-12.4 Time For Submittal Of Claim

Any Claim must be submitted by Contractor within sixty (60) days after (i) written protest to an approved change order under Section 4-10, "Changes," or (ii) City's rejection of Contractor's proposed change order under Section 4-12.3, "Proposed Change Orders;" however, notwithstanding the above, any and all Claims must be submitted no later than seven (7) days after the Engineer certifies the Work as complete and ready for acceptance by the City Council. Failure to timely

submit a Claim acts as a complete waiver of Contractor's right to recover money or time on the issues for which a Claim was required. In no event will the Contractor be allowed to reserve its rights to assert a Claim for time extension or additional cost later than as required by this provision unless the Owner agrees in writing to allow such reservation. Before expiration of the time for submitting a Claim, Contractor may ask once in writing for a fifteen (15) day extension of any deadline for submission of a Claim, and Owner shall grant such extension if reasonable grounds exist. However, no further extensions shall be permitted, and any failure by Contractor to timely ask for an extension waives Contractor's right to an extension.

4-12.5 Content Of Claim

4-12.5.1 Claim Format

Every Claim shall be in writing. In addition, the Contractor shall certify each and every Claim at the time of submission, as follows:

> I, [name of declarant], declare the following:
>
> [Contractor company name] has contracted with [public entity name] for the [name of project] project. I am authorized by my employer ([contractor company name]) to prepare the attached claim for compensation (in other words, for money and/or time extensions) to [public entity name] regarding this project (dated _____, 200_, entitled _____, and requesting $_____ and/or ___ additional working days), and I prepared said attached claim. I am the most knowledgeable person at [contractor company name] regarding this claim.
>
> I am aware of all law that relates to and governs this claim, including but not limited to California Penal Code section 72, Government Code sections 12650 et seq. (False Claims Act), and Business and Professions Code sections 17200 et seq. (Unfair Business Practices Act). I am aware that submission or certification of false claims, or other claims that violate law or the contract, may lead to fines, imprisonment, and/or other severe legal consequences for myself and/or [contractor company name].
>
> The attached claim is prepared and submitted in good faith, does not breach the contract between [contractor company name] and [public entity name] for this project, is not a false claim, does not violate any law, satisfies all provisions of the contract, only contains truthful and accurate supporting data, and only requests an amount that accurately reflects the adjustments to money and time for which I honestly and in good faith believe that [public entity name] is responsible under its contract with [contractor company name].
>
> So that I could declare that the statements in this declaration and the attached claim were true and correct, while preparing this declaration and claim I consulted with others (including attorneys, consultants, or others who work for [contractor company name]) when necessary to assure myself that said statements were true and correct.
>
> I declare under the penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed _____, 20__, at _____, California.
>
> _____
> [name of declarant]

Contractor understands and agrees that any Claim submitted without this certification does not meet the terms of the Contract Documents; that Owner, or Owner's representatives, may reject the Claim on that basis; and that unless Contractor properly and timely files the Claim with the certification, Contractor cannot further pursue the Claim in any forum and all rights to further compensation (money or time) regarding the issues covered by the Claim are waived due to a condition precedent not having been satisfied.

4-12.5.2 Claims For Additional Payment

If the Contractor wishes to make a Claim for additional monetary payment from Owner, the Claim shall include all facts and documents supporting the Claim, including but not limited to (a) the amount being claimed, including calculations, (b) why the claimed cost was incurred, (c) why the claimed cost is the responsibility of the Owner, and (d) why the claimed cost is a reasonable amount.

4-12.5.3 Claims For Additional Time And Cost

4-12.5.3.1 Notice And Extent Of Claim

If the Contractor wishes to make a Claim for an increase in the Contract time, the Claim shall include all facts supporting the Claim, including but not limited to (A) a current schedule and delay analysis explaining (i) the nature of the delay, (ii) the Owner's responsibility for the claimed delay, (iii) the claimed delay's impact on the critical path, and (iv) the claimed delay's impact on completion date (including an analysis of float previously used and still remaining), and (B) all facts and documents supporting any claim for additional compensation related to the increase in Contract time (see 4-12.5.2, "Claims for Additional Payment." In the case of a continuing delay, only one (1) initial Claim is necessary that is based on estimates of when the continuing delay will end, but within thirty (30) days of the end of the continuing delay an updated final Claim must be submitted.

4-12.5.3.2 Adverse Weather Claims

If unusually severe weather conditions (i.e., those conditions beyond the weather conditions that are within Contractor's scope (see Section 8-8, "Time of Completion") are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were excessive, could not have been reasonably anticipated, and had an unavoidable adverse effect on the critical path of the scheduled construction.

4-12.5.4 "Pass Through" Claims

If any portion of a Claim is based on a request for additional compensation (money or time) by one of Contractor's subcontractors or suppliers, the Contractor must prepare and submit (as part of its Claim) its own analysis of the subcontractor's request, and the Claim must include a copy of the subcontractor's request along with any other necessary supporting documentation. In addition to conforming to all requirements of this Section 4-12 regarding Claims, the Contractor's analysis of the subcontractor's request must include a detailed explanation by Contractor of why the request by subcontractor or supplier is the City's responsibility, including Contractor's analysis of (a) why the amount of damages is appropriate, (b) how a breach by Contractor caused the subcontractor or supplier to incur these damages, and (c) how the Contractor's breach was caused by a breach by City. A subcontractor or supplier may not submit a claim directly to the City since it does not have a contract with the City, and a Contractor may not simply forward such a claim to the City.

4-12.6 Procedures For Claims Less Than Or Equal To $375,000
(Public Contract Code §20104.2)

4-12.6.1 Claims Less Than $50,000
For Claims of less than fifty thousand dollars ($50,000), the City shall respond in writing to any written Claim within 45 days of receipt of the Claim, or may request, in writing, within 30 days of receipt of the Claim, any additional documentation supporting the Claim or relating to defenses to the claim the City may have against the Contractor.

If additional information is thereafter required, it shall be requested and provided pursuant to this subdivision, upon mutual agreement of the City and Contractor.

The City's written response to the Claim, as further documented, shall be submitted to the Contractor within 15 days after receipt of the further documentation, or within a period of time no greater than that taken by the Contractor in producing the additional information, whichever is greater.

4-12.6.2 Claims Over $50,000 And Less Than $375,000
For claims over fifty thousand dollars ($50,000) and less than or equal to three hundred seventy-five thousand dollars ($375,000), the City shall respond in writing to all written Claims within 60 days of receipt of the Claim, or may request, in writing, within 30 days of receipt of the Claim, any additional documentation supporting the Claim or relating to defenses to the Claim the City may have against the Contractor.

If additional information is thereafter required, it shall be requested and provided pursuant to this subdivision, upon mutual agreement of the City and Contractor.

The City's written response to the Claim, as further documented, shall be submitted to the Contractor within 30 days after receipt of the further documentation, or within a period of time no greater than that taken by the Contractor in producing the additional information, whichever is greater.

4-12.6.3 Meet And Confer
If the Contractor disputes the City's written response, or the City fails to respond within the time prescribed, the Contractor may so notify the City, in writing, either within 15 days of receipt of the City's response or within 15 days of the City's failure to respond within the time prescribed, respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon a demand, the City shall schedule a meet and confer conference within 30 days for settlement of the dispute. The conference may take place during regularly scheduled project meetings.

4-12.6.4 Government Code Claims
Following the meet and confer conference, if the Claim or any portion remains in dispute, the Contractor **must** file a claim as provided in Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code (a "Government Code Claim"). The process of filing of a Government Code Claim is specifically required in addition to the contractual claims process in these Standard Specifications; such contractual claims process described above does not act as a substitute for the Government Code Claim process, and the two procedures shall be sequential.

Failure to timely file a Government Code Claim shall act as complete waiver by Contractor of the disputed item. The Government Code Claim shall be handled by Contractor and City as required by the Government Code, commencing with Section 900. For purposes of the applicable Government

Code provisions, the running of the period of time within which a Government Code Claim must be filed shall be tolled from the time the Contractor submits his or her written Claim pursuant to this Section 4-12 until the time that such Claim is denied as a result of the meet and confer process in Section 4-12.6.3, including any time utilized by such meet and confer process.

4-12.7 Procedures For Claims Over $375,000

Claims over $375,000 shall be handled by Contractor and City in the same manner as Claims of $375,000 or less (see Section 4-12.6, "Procedures for Claims Less Than or Equal to $375,000), except that City shall (a) respond in writing to all written Claims within 90 days of receipt of the Claim, or may request, in writing, within 45 days of receipt of the Claim, any additional documentation supporting the Claim or relating to defenses to the Claim the Owner may have against the Contractor, and (b) respond within 45 days after receipt of the further documentation, or within a period of time no greater than that taken by the Contractor in producing the additional information, whichever is greater.

4-12.8 Closeout Meet And Confer

Before the submission of a final payment application, Contractor may request a closeout meet and confer session with the City to discuss any previously submitted Claims that the City did not grant in full. City is under no obligation to meet and confer, but may in its discretion choose to do so. Nothing related to this closeout meet and confer process tolls the running of the period of time for Contractor to present a Government Code Claim pursuant to Sections 4-12.6, "Procedures for Claims Less Than or Equal to $375,000," and 4-12.7, "Procedures for Claims Over $375,000."

4-12.9 Continuing Contract Performance

Despite submission or rejection of a Claim, the Contractor shall proceed diligently with performance of the Contract as directed by City, and the City shall continue to make any undisputed payments in accordance with the Contract.

4-13 Interim Cleanup

During the construction of the project, the Contractor shall provide periodic cleanup as the work progresses, such cleanup to be accomplished as soon as practicable and as public necessity and convenience require, as determined by the Engineer. In general, daily interim cleanup will be required.

If the Contractor fails to provide periodic cleanup measures so ordered within a reasonable time period as determined by the Engineer, the shall pay to the City a liquidated damage of a minimum of Two Hundred Fifty Dollars ($250.00) for each calendar day, or portion thereof, that elapses from the time the penalty is ordered into effect by the Engineer, until periodic cleanup measures ordered by the Engineer are completely carried out and the nuisance eliminated or prevented. Such penalty shall be deducted in accordance with Section 9-7, "Stop Notices; City's Right To Withhold Payments," from any monies owed the Contractor, or levied as a fine in the case of non-public work. In addition to the liquidated damage as specified above, if conditions warrant, the Engineer may order other forces to provide interim cleanup. The full cost thereof, in addition to the liquidated damage as herein provided, shall be deducted from any monies owed the Contractor or shall be levied as a fine in the case of non-public work.

Full compensation for cleanup during construction shall be included in the prices bid for the various items of work; no separate payment will be made therefor.

4-14 Detours

Detours installed or constructed by the Contractor around the work or any portions thereof, whether requested by the Contractor or required by the Plans or the Specifications for use by traffic shall conform to Sections 7-17, "Public Convenience," 7-18, Public Safety," and Section 12, "Traffic Control; Construction Area Traffic Control Devices." Unless otherwise specified in the Contract Specifications, payment for installing and removing detours shall be included in the price bid for Traffic Control, or if there is no bid item, included in the various bid items of work. No additional payment will be made therefor. The Contractor shall be aware that detours which pass through jurisdictions other than the City of Clovis may be subject to special requirements by those jurisdictions. Any costs thereof shall be paid for as above provided.

When traffic is routed through the work, provisions for a passageway through construction operations shall also conform to the foregoing Sections, but will not be considered as detour construction or detour maintenance. This work shall conform to and be paid for as provided in Section 7-17, "Public Convenience," unless otherwise specified in the Contract Specifications.

In accordance with Section 8-11, "Temporary Suspension of Work," the failure or refusal of the Contractor to construct and maintain detours at the proper time or route traffic through the works as required shall be sufficient cause for closing down the work until the detours or rerouting are in satisfactory condition for use by traffic.

Any damage caused by the Contractor's operations or by traffic to detours installed solely for the convenience of the Contractor and not required by the Plans, Specifications, or the Engineer, shall be promptly repaired by the Contractor to the satisfaction of the Engineer.

SECTION 5 - CONTROL OF WORK

5-1 Authority Of The Engineer

The Engineer shall decide all questions which may arise as to the quality or acceptability of materials furnished and work performed and as to the manner of performance and rate or progress of the work, all questions which may arise as to the interpretation of the Plans and Specifications, all questions as to the acceptable fulfillment of the Contract on the part of the Contractor, and all questions as to compensation, including any claims and change orders under Section 4-10, "Changes," Section 4-12, "Notices, Change Orders, and Claims," and Section 9-5, "Payment for Extra Work." The Engineer's decision shall be final and binding upon the Contractor. The Engineer shall also have the authority to enforce and make effective such decisions and orders which the Contractor fails to carry out promptly. In accordance with Section 5-17, "Inspection during Construction," the Engineer will delegate authority to representative inspectors to assure compliance with Plans and Specifications.

5-2 Standards

The Engineer shall establish such standards as may be necessary for the proper construction of a finished product. In the absence of specific standards, recognized standards of construction or approved practices shall govern the work.

5-3 Contractor's Responsibility For The Work

Except as specifically provided in these Standard Specifications, until the formal acceptance of the work by the City Council, the Contractor shall have the charge and 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 nonexecution 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 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 the Specifications.

The Contractor shall comply with the requirements of Sections 5-9, "Preservation of Property," and 7-16, "Injury or Damage to Persons or Property."

5-4 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 equipment which is obsolete as to type, in bad condition, or worn out will not be permitted on the work.

5-5 Suitable Methods

The Contractor shall use such methods for the performance of the work embraced under these Specifications as will secure a satisfactory quality of work and rate of progress. Such methods shall meet the approval of the Engineer, and shall be submitted for approval before being used on the work. The Engineer reserves the right, during the progress of the work, to make suggestions and revisions in the methods in order that a high quality of work and satisfactory rate of progress may be obtained. When ordered by the Engineer, the Contractor shall discontinue unsuitable methods of work.

5-6 Order Of Work

Where required by the Plans or Specifications, the Contractor shall follow the sequence of operations as set forth therein.

Full compensation for conforming to those requirements will be considered as included in the prices paid for the various contract items of work and no additional compensation will be allowed therefor.

5-7 Superintendence And Personnel

The Contractor shall designate in writing before starting work, an authorized representative who shall have the authority to represent and act for the Contractor, to receive suggestions or direction from the Engineer or Inspector and to see them faithfully executed. The Contractor shall provide the name, address, and phone number of each such superintendent or foreman so designated. When the Contractor is comprised of 2 or more persons, firms, partnerships or corporations functioning on a joint venture basis, the Contractor shall designate in writing before starting work, the name of one authorized representative who shall have the authority to represent and act for the Contractor.

The authorized representative shall be present at the site of the work at all times while work is actually in progress on the contract. When work is not in progress and during periods when work is suspended, arrangements acceptable to the Engineer shall be made for any emergency work which may be required.

Whenever the Contractor or the Contractor's authorized representative is not present on any particular part of the work where it may be desired to give direction, orders will be given by the Engineer which shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which the orders are given.

Any order given by the Engineer, not otherwise required by the Specifications to be in writing, will on request of the Contractor, be given or confirmed by the Engineer in writing.

If any subcontractor, workman, 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, that person shall be removed from the work immediately upon notice by the Engineer and may not be employed again on the work.

All work shall be under general observation and inspection of the Engineer or the Inspector and any work done without the sanction or presence of the Engineer or Inspector will be subject to rejection.

5-8 Emergency Availability

The Contractor shall furnish to the Engineer, prior to the issuance of a "Notice to Proceed," a list of persons, together with their addresses and 24-hour telephone numbers, who are authorized to act on behalf of the Contractor in an emergency arising out of conditions at the work site after normal working hours. The Contractor shall conform to the requirements in Section 7-18, “Public Safety.”

5-9 Preservation Of Property

In accordance with Sections 5-3, “Contractor’s Responsibility For Work,” and 7-16, “Injury or Damage to Persons or Property,” the Contractor shall be liable for any and all damage done to any public or private property, structure, facility or improvement due to his operations. Due care shall be exercised to avoid injury to existing street improvements or facilities, roadside trees and landscaping that are not to be removed, pole lines, fences, signs, survey markers and monuments, buildings and structures, conduits, pipelines under or above ground, all street facilities, and any other improvements or facilities within or adjacent to the work area, or on private property adjacent to the work area, and all such facilities shall be protected from injury or damage. The Contractor shall provide and install suitable, approved safeguards to protect property or improvements from injury or damage.

If property or improvements 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 the specifications being performed under this Contract. In certain cases, where the Contractor damages an existing facility such as a curb return and or landing, the Engineer may require the Contractor at his expense to reconstruct the return to meet current Americans With Disabilities Act (ADA) requirements and standards.

The Engineer may make or cause to be made such temporary repairs as are necessary to restore to service any damaged facility. The cost of such repairs shall be borne by the Contractor and may be deducted by the City from any monies due or to become due to the Contractor under the Contract.

5-10 Protection Of The Work

The Contractor shall provide and maintain proper barricades, fences, signal lights or watchmen to properly protect the work, persons, animals, and property against injury. The cost of such protection shall be included in the amount bid for the various items of work.

In accordance with Section 7-18, "Public Safety," the Engineer reserves the right to remedy any situation, condition, or neglect on the part of the Contractor as regards the protection of the work, the public, or property and to deduct the cost of such remedy from money due the Contractor, or levy as a fine in the case of non-public work.

5-11 Rights Of Way

The City will provide the right of way for the work to be constructed as shown on the Plans. The Contractor shall procure at no cost to the City all temporary construction easements not shown in the Plans, which the contractor may deem necessary to carry out the work to be done under the Contract. The Contractor shall bring said temporary construction easements to a condition at least equal to that existing prior to their use, to the satisfaction of the Engineer. The Contractor shall not occupy property outside the right-of-way shown on the Plans, except by written agreement with the owner of said property, a copy of which shall be provided the Engineer.

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 owner, former owner, or tenant of such land, structure or building.

5-12 Disposal Of Material Outside The Right Of Way

The Contractor shall make arrangements for the legal disposal of non-hazardous materials outside the right of way and shall pay all costs involved. Disposal of hazardous material shall be handled in accordance with Section 7-14, "Trenches and Excavations; Hazardous Waste." No recyclable material shall be disposed of at any landfill. All disposable recyclable materials shall be disposed in a manner that facilitates recycling. A certificate of compliance stating disposal location and manner of disposal of recyclable materials shall be submitted to the Engineer.

When any material is to be disposed of outside the right of way, the Contractor shall first obtain a written permit from the property owner on whose property the disposal is to be made and shall file with the Engineer said permit or a certified copy thereof. When material is disposed of as above provided, the Contractor shall conform to all requirements of the City Municipal Code pertaining to grading, hauling and filling of earth, including any permits or bonds so required. Hauling of any materials from the work site shall conform to the provisions in Section 6-12, "Materials Hauling."

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

that has been used or damaged by his operations. Full compensation for all costs involved in disposing of materials as specified in this Section 5-12, including all costs of hauling and any landfill or other fees, shall be considered as included in the price paid for the Contract items of work involving such materials and no additional compensation will be allowed therefor. No additional payment will be granted the Contractor for inconvenience or delays encountered in complying with the requirements of this Section 5-12.

5-13 Electric And Water Service

The Contractor shall provide and pay for electric service for 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 make arrangements for and shall acquire a water supply for the work done under the Contract. The Contractor shall pay for all water so used. In accordance with the provisions of Section 17, "Water Use," water to be used in work contracted to the City may be taken from the City's water system, at a location approved by the City. If taken from the City's water system, the Contractor shall obtain a water meter from the Utilities Division of the City Public Utilities Department, and pay any deposits or fees required therefor, including charges for water used. Failure to return the meter at specified intervals for reading, and/or late return of the meter when the work is completed, will result in additional fees. A backflow prevention device may be required by the City and shall be furnished and installed by the Contractor prior to any water being taken from the City's system.

Water taken from a source other than the City system shall be approved by the Engineer in advance. Such water shall be chemically and biologically suitable for the intended use.

In conformance with Section 20, "Landscape Planting," and Section 21, "Landscape Irrigation Systems," the water supply for landscape planting and irrigation systems shall be provided by the Contractor in accordance with the Plans and Specifications. A permanent water meter will be furnished by the City for each irrigation system connection to the City water system unless otherwise specified. The Contractor will be charged for all water consumed through these connections, in addition to water consumed through the hydrant meter, including water consumed for testing purposes and for landscape irrigation through the 90-day maintenance period and up to final acceptance of the work by the Engineer.

All costs for furnishing electric service and water, including water consumed for landscape irrigation and irrigation system testing, shall be included in the various related bid items of work; no additional payment will be made therefor.

5-14 Construction Surveying/Staking

Unless otherwise specified in the Contract Specifications, construction surveying and staking shall be provided by the Contractor. Surveying and staking shall be conducted only by a person licensed by the State of California to practice Land Surveying. Surveying shall conform to the quality and practice required by the Engineer. The Engineer shall be notified before surveying and/or construction staking commences. The contractor shall furnish cut-sheets prepared by the surveyor to the Engineer immediately upon the setting of the grades.

The Contractor shall preserve construction survey stakes and marks for the duration of their usefulness. The Contractor shall be responsible for the replacement cost of any lost or disturbed construction staking necessary to complete the work.

The Contractor shall immediately inform the Engineer in writing of any discrepancies discovered during the course of the work between the Plans and the construction staking, and the Engineer shall promptly verify the same. Any work done after such discovery, until authorized, will be done at the Contractor's risk.

Three 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. Any deviation of constructed facilities from the grades shown on the Plans and staked in the field shall be the responsibility of the Contractor.

Grades for underground conduits will be set at the surface of the ground and the Contractor shall be responsible for transferring such grades to the bottom of the trench.

The Contractor shall preserve property line and corner survey markers, except where their destruction is unavoidable when the Contractor is proceeding in accordance with accepted practice. Markers that are lost or disturbed by his operations shall be replaced at the Contractor's expense by a person appropriately licensed by the State of California for Land Surveying. The Contractor shall comply with the provisions in Section 70-2, "Survey Monuments."

The costs for furnishing Construction Surveying and Staking by the Contractor shall be included in the amount bid for the various items of work; no separate payment will be made therefor.

5-15 Cooperation

The Contractor shall cooperate in all respects with all public and private agencies, including the Fresno Irrigation District, Fresno Metropolitan Flood Control District, Cable TV and Telephone Companies, Pacific Gas and Electric Company, the Fresno and Clovis City Water, Sewer, Parks, Solid Waste, Streets and Traffic Divisions and the respective Fire and Police Departments

The Contractor shall comply with the provisions in Section 8-15, "Utility and Non-Street Facilities; Potholing." Should construction be under way by other forces or by other contractors within or adjacent to the limits of the work specified or should work of any other nature be under way by other forces within or adjacent to those limits, the Contractor shall cooperate with all the other contractors or other forces to the end that any delay or hindrance to their work will be avoided. The right is reserved to perform other or additional work at or near the site (including material sources) at any time, by the use of other forces.

When 2 or more contractors are employed on related or adjacent work, or obtain materials from the same material source, each shall conduct their operations in such a manner as not to cause any unnecessary delay or hindrance to the other. Each contractor shall be responsible to the other for all damage to work, to persons or property caused to the other by their operations, and for loss caused the other due to unnecessary delays or failure to finish the work within the time specified for completion.

5-16 Maintaining Drainage

The Contractor shall provide and maintain drainage to the area of work. Temporary provisions for drainage of any area during construction where existing drainage facilities have been damaged or altered or where normal drainage patterns of adjacent areas will be interrupted by the Contractor during his operations, shall be made by the Contractor and as directed by the Engineer.

The Contractor shall be responsible for all damages to public or private property upstream or downstream of the work incurred due to failure to provide adequate drainage within and through the construction area or due to blockage of existing drainage facilities or pathways at or upstream from the area of work, or for re-routing flows to areas not historically receiving such drainage.

In the performance of Maintaining Drainage, the Contractor shall comply in all respects with Section 7-7, "Water Pollution Prevention."

The costs for Maintaining Drainage by the Contractor shall be included in the amount bid for the various items of work; no separate payment will be made therefor.

5-17 Inspection During Construction; Meetings

As provided in Section 5-1, "Authority of the Engineer," the Engineer will delegate authority to a representative Inspector who shall at all times have access to the work during construction and shall be furnished with every reasonable facility for ascertaining full knowledge relative to the progress, workmanship, and character of materials used and employed in the work. The Contractor shall provide facilities necessary to ensure the safety of the Engineer, City inspectors, and the personnel of authorized testing firms as appropriate. The City and its agents, employees, inspectors and testing firms may videotape, audiotape, or photograph any aspect of the Work or Contractor's activities as part of their documentation of the project and certain issues.

Whenever the Contractor varies the day, or period of the day, during which work is performed, 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 is subject to rejection.

For non-public work conducted under a City Permit, reference is made to Section 7.2.03 of the City of Clovis Municipal Code regarding inspection fees and re-inspection fees. Such fees shall be applied in accordance with the fee schedule in effect at the time of permit issuance.

The inspection, approval and/or acceptance of the work shall not relieve the Contractor of any 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 may have been previously overlooked by the Engineer or Inspector and accepted, or estimated for payment.

Projects financed in whole or in part with funds from sources other than the City shall be subject to inspection at all times by the agency providing said funds or its authorized agent.

When specified in the Contract Specifications, the Contractor shall meet no less than weekly with the City to review all construction issues. The City shall prepare minutes for each meeting and forward them to Contractor; Contractor's failure to correct the minutes within four (4) days shall be deemed agreement with the content of the minutes. Either party has the right to audiotape or videotape the weekly meeting.

5-18 Differing Site Conditions

During the progress of the work, if subsurface or latent physical conditions are encountered at the site differing materially from those indicated in the contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract, are encountered at the site, the party discovering those conditions shall promptly notify the other party in writing of the specific differing conditions before they are disturbed and before the affected work is performed.

Upon written notification from the Contractor, the Engineer will investigate the conditions, and if the Engineer determines that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the contract, an adjustment, excluding loss of anticipated profits, will be made and the contract modified in writing accordingly. The Engineer will notify the Contractor of the Engineer's determination whether or not an adjustment of the contract is

warranted. No contract adjustment which results in a benefit to the Contractor will be allowed unless the Contractor has provided the required written notice.

No contract adjustment will be allowed under the provisions specified in this section for any effects caused on unchanged work.

Any contract adjustment warranted due to differing site conditions will be made in conformance with the provisions in Section 4-10, "Changes," and Section 4-12, Notices, Change Orders, and Claims."

5-19 Removal Of Defective Or Unauthorized Work

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

Any work done beyond the lines and grades shown on the Plans or established by the Engineer or any extra work done without written authority will be considered as unauthorized and will not be paid for.

5-20 Surface Restoration

The Contractor shall replace all graded surface material adjacent and/or appurtenant to the work removed, disturbed, or damaged by the Contractor's operations, and shall restore paving, curbing, sidewalks, gutters, landscaping, fences, lawn and other surfaces disturbed, to a condition equal to that before the work began or as indicated in the Contract Specifications or Plans, and shall furnish all labor and material incidental thereto. Where bid items are not provided for each type of restoration, full compensation therefor shall be included in the amount bid for the various items of Contract work. The Contractor shall comply with the provisions Section 19-3.05, "Restoration of Surfaces."

5-21 Final Cleanup

When construction is completed, and prior to application for acceptance of the work, the Contractor shall clean all work areas and all grounds occupied by him in connection with the work of all debris, excess materials, temporary structures and equipment. All portions of the work shall be left in a neat, presentable condition. The roadways in which construction operations have been accomplished, as well as all haul roads upon which spillage has occurred, shall be swept clean, as directed by the Engineer. Roads adjacent to construction activity which have received dirt or debris tracked from the construction area shall also be swept and cleaned. Upon completion of Final Cleanup, the Contractor shall notify the Engineer in writing that the work is complete in all parts and requirements and ready for final inspection as provided in Section 5-22, "Final Inspection."

If the Contractor fails to provide Final Cleanup to the satisfaction of the Engineer, a final inspection will not be performed by the Engineer until such cleanup is provided. If the contract time is exceeded due to the Contractor's failure to provide, or is late in providing, the required final cleanup, the provisions of Section 8-9, "Liquidated Damages," will be applied.

All costs for providing Final Cleanup shall be included in the various bid items of work; no additional payment will be made therefor.

5-22 Final Inspection

Whenever the Work provided and contemplated by the Contract has been completed in all parts and requirements and the final cleanup performed in accordance with Section 5-21, "Final Cleanup," the Contractor shall request in writing a final inspection be made by the Engineer. The written request shall include a statement that the Work has been completed in all parts and requirements of the Contract. For projects involving landscaping and irrigation systems, the 90-day maintenance period provisions of Sections 20-8, "Maintenance Period," and 21-12, "Maintenance Period," apply.

The Engineer will determine the adequacy of the final cleanup, and if found not to be in compliance with said Section 5-21, will not make the final inspection and instead direct the Contractor to perform additional cleanup as required until compliance is reached.

Upon making a determination that the final cleanup is in compliance with said Section 5-21, the Engineer will conduct a final inspection. Representatives from various City Departments as well as other agencies who will own, operate, and maintain the improvements constructed by the Contractor will participate in the final inspection. The inspection will be completed within a maximum of ten (10) working days. The time required by the Engineer and others to conduct the final inspection will not be counted against the allotted time for completion of the contract.

Upon completion of the final inspection, a list of items needing correction to comply with the contract documents, if any, will be provided by the Engineer to the contractor. The time required to make such corrections will be charged against the allotted time for completion of the Contract.

Failure to complete the work in all parts and requirements of the contract including providing Final Cleanup in a timely manner to allow sufficient time to accomplish corrective work, any of which results in an overrun in contract time, the provisions of Section 8-9, "Liquidated Damages," will be applied.

5-23 Guarantee Of Workmanship

In conformance with Sections 3-5, "Materials Statement, Samples and Guarantees," 6-10, "Guarantee of Materials," and 7-23, "Guarantee," the Contractor shall guarantee all materials, equipment and workmanship of the installation and Work for a period of one year from the date of Acceptance of the Work by the City Council. Additional longer guarantees may be required by the Contract Specifications. 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 Contract, including the Plans and Specifications, the Contractor shall be notified within the time period of the Guarantee, and shall immediately perform, at Contractor's expense, the necessary repairs or replacements to make the defective item or items suitable and satisfactory. Expiration of the Guarantee time period shall not void an obligation of the Contractor which is based on a timely notice by the City. Should exigencies necessitate the repairs before the Contractor could be notified, or should the Contractor refuse to make the repairs or replacements within a reasonable period of time, the Engineer 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 failure.

This guarantee provision applies to all work performed in City right of way or property, whether by contract with the City or work performed under Encroachment Permit by or for utility or communications companies or other private entities. For work done under Encroachment Permit, failure to correct or pay for defective workmanship or materials may result in denial of future permits to perform work in City rights of way or property.

All costs for providing all required Guarantees of Workmanship shall be included in the various bid items; no additional payment will be made therefor.

5-24 Cost Reduction Incentive

The Contractor may submit to the Engineer, in writing, proposals for modifying the Plans, Specifications, or other requirements of the contract for the sole purpose of reducing the total cost of construction. The cost reduction proposal shall not impair, in any manner, the essential functions or characteristics of the project, including but not limited to service life, economy of operation, ease of maintenance, desired appearance, or design and safety standards.

Cost reduction proposals shall contain the following information:

1. A description of both the existing Contract requirements for performing the work and the proposed changes.
2. An itemization of the contract requirements that must be changed if the proposal is adopted.
3. A detailed estimate of the cost of performing the work under the existing contract and under the proposed change. The estimates of cost shall be determined in the same manner as if the work were to be paid for on a force account basis as provided in Section 9-1.03, "Force Account Payment," of the State Standard Specifications.
4. A statement of the time within which the Engineer must make a decision thereon.
5. The contract items of work affected by the proposed changes, including any quantity variation attributable thereto.

The provisions of this Section 5-24 shall not be construed to require the Engineer to consider any cost reduction proposal which may be submitted hereunder; proposed changes in basic design of a bridge or of a pavement type will not be considered as an acceptable cost reduction proposal; and the City will not be liable to the Contractor for failure to accept or act upon any cost reduction proposal submitted pursuant to this section nor for any delays to the work attributable to any cost reduction proposal. If a cost reduction proposal is similar to a change in the Plans or Specifications under consideration by the City for the project at the time the proposal is submitted, or if the proposal is based upon or similar to these Standard Specifications, the Contract Specifications or Standard Drawings adopted by the City after the advertisement for the contract, the Engineer will not accept the proposal, and the City reserves the right to make the changes without compensation to the Contractor under the provisions of this section.

The Contractor shall continue to perform the work in accordance with the requirements of the contract until an executed change order, incorporating the cost reduction proposal has been issued. If an executed change order has not been issued by the date upon which the Contractor's cost reduction proposal specifies that a decision thereon should be made, or such other date as the Contractor may subsequently have specified in writing, the cost reduction proposal shall be deemed rejected.

The Engineer shall be the sole judge of the acceptability of a cost reduction proposal and of the estimated net savings in construction costs from the adoption of all or any part of the proposal. In determining the estimated net savings, the right is reserved to disregard the contract bid prices if in the judgment of the Engineer, those prices do not represent a fair measure of the value of work to be performed or to be deleted.

The City reserves the right where it deems such action appropriate, to require the Contractor to share in the City's costs of investigating a cost reduction proposal submitted by the Contractor as a condition of considering the proposal. Where this condition is imposed, the Contractor shall indicate acceptance thereof in writing, and that acceptance shall constitute full authority for the City to deduct amounts payable to the City from any moneys due or that may become due to the Contractor under the contract.

If the Contractor's cost reduction proposal is accepted in whole or in part the acceptance will be by a contract change order, which shall specifically state that it is executed pursuant to this Section 5-24. The change order shall incorporate the changes in the plans and specifications which are necessary to permit the cost reduction proposal or that part of it as has been accepted to be put into effect, and shall include any conditions upon which the City's approval thereof is based if the approval of the City is conditional. The change order shall also set forth the estimated net savings in construction costs attributable to the cost reduction proposal effectuated by the change order, and shall further provide

that the Contractor be paid 50 percent of that estimated net savings amount. The Contractor's cost of preparing the cost reduction incentive proposal and the City's costs of investigating a cost reduction incentive proposal, including any portion thereof paid by the Contractor, shall be excluded from consideration in determining the estimated net savings in construction costs.

Acceptance of the cost reduction proposal and performance of the work thereunder shall not extend the time of completion of the Contract unless specifically provided for in the contract change order authorizing the use of the cost reduction proposal. The amount specified to be paid to the Contractor in the change order which effectuates a cost reduction proposal shall constitute full compensation to the Contractor for the cost reduction proposal and the performance of the work thereof pursuant to the change order.

The City expressly reserves the right to adopt a cost reduction proposal for general use on contracts administered by the City when it determines that the proposal is suitable for application to other contracts. When an accepted cost reduction proposal is adopted for general use, only the Contractor who first submitted that proposal will be eligible for compensation pursuant to this section, and in that case, only as to those contracts awarded to that Contractor prior to submission of the accepted cost reduction proposal and as to which the cost reduction proposal is also submitted and accepted. Cost reduction proposals identical or similar to previously submitted proposals will be eligible for consideration and compensation under the provisions of this Section 5-24 if the identical or similar previously submitted proposals were not adopted for general application to other contracts administered by the City. Subject to the provisions contained herein, the City shall have the right to use all or any part of any submitted cost reduction proposal without obligation or compensation of any kind to the Contractor.

SECTION 6 - CONTROL OF MATERIALS

6-1 Source Of Supply And Quality Of Materials

The Contractor shall furnish all materials required to complete the work. Only materials conforming to the requirements of the specifications shall be incorporated in the work. The materials furnished and used shall be new, except as may be provided elsewhere in these specifications, on the plans or in the special provisions. The materials shall be manufactured, handled and used in a workmanlike manner to ensure completed work in accordance with the plans and specifications. Materials to be used in the work will be subject to inspection and tests by the Engineer or the Engineer's designated representative. The Contractor shall furnish without charge such samples as may be required.

The Contractor shall furnish the Engineer a list of the Contractor's sources of materials and the locations at which those materials will be available for inspection. The list shall be furnished to the Engineer in sufficient time to permit inspecting and testing of materials to be furnished from the listed sources in advance of their use. The Engineer may inspect, sample or test materials at the source of supply or other locations, but the inspection, sampling or testing will not be undertaken until the Engineer is assured by the Contractor of the cooperation and assistance of both the Contractor and the supplier of the material. The Contractor shall assure that the Engineer or the Engineer's authorized representative has free access at all times to the material to be inspected, sampled or tested.

It is understood that the inspections and tests if made at any point other than the point of incorporation in the work in no way shall be considered as a guaranty of acceptance of the material nor of continued acceptance of material presumed to be similar to that upon which inspections and tests have been made, and that inspection and testing performed by the Engineer shall not relieve the Contractor or the Contractor's suppliers of responsibility for quality control.

Manufacturers' warranties, guaranties, instruction sheets and parts lists which are furnished with certain articles or materials incorporated in the work, shall be delivered to the Engineer before acceptance of the contract. Reports and records of inspections made and tests performed, when available at the site of the work, may be examined by the Contractor.

6-2 Storage And Protection Of Materials

The Contractor shall provide and maintain storage facilities and employ such measures as will preserve the specified quality and fitness of materials to be used in the work. Stored materials shall be reasonably accessible for inspection. The Contractor shall also adequately protect new and existing work and all items of equipment for the duration of the Contract.

6-3 Defective Material

All materials not conforming to the requirements of the 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 to the Contractor.

6-4 Trade Names Or Equal

Whenever the material or article to be furnished is described by trade name, brand name, or other reference is made to specific manufacturer or supplier, "or approved equal," or "City approved equal," it shall be understood that the use of a trade name or brand name is intended to describe a specific quality of material to be used in the project. The City's intention shall not be interpreted to exclude or omit the products of any responsible manufacturer if such products are equal or superior in every respect to those specifically described.

No substitutions shall be used in the work without prior approval of the Engineer. The burden of proof as to the quality and suitability of alternatives shall be upon the Contractor, and the Contractor shall furnish all information necessary as required by the Engineer. The Engineer shall be the sole judge as to the quality and suitability of alternative articles or materials, and the Engineer's decision shall be final.

Upon submittal by the Contractor, the Engineer will determine the acceptability of the requested substitution, which may include such samples and tests as may be required by Section 6-8, "Samples and Tests," herein. In such cases of proving equal status, the Contractor shall pay the costs of required testing. No time extension to any Contract will be allowed due to any such proposed substitution, or the time required to determine the acceptability of such substitutions.

6-5 Certificates 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 Plans and Specifications shall be supplied to the Engineer upon request, or if required to be submitted by the Contract Specifications. 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. Certificates of Compliance shall be provided in triplicate and shall be submitted to the Engineer for review prior to the use of the product or material in the work.

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

The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer. No additional payment will be made for furnishing certificates and all costs incurred shall be included in the prices bid for other items of work.

6-6 Foreign Materials

Materials which are manufactured, produced or fabricated outside of the United States shall be delivered to a distribution point in California, unless otherwise required in these Standard Specifications or the Contract Specifications, where they shall be retained for a sufficient period of time to permit inspection, sampling and testing. The Contractor shall not be entitled to an extension of time for acts or events occurring outside of the United States, and it shall be the Contractor's responsibility to deliver materials obtained from outside of the United States to the point of entry into the continental United States in sufficient time to permit timely delivery to the job site. The provisions in Section 8-9, "Liquidated Damages," will apply.

The manufacturer, producer, supplier, or fabricator of foreign material shall furnish to the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-5 "Certificates of Compliance." In addition, certified mill test reports clearly identifiable to the lot of material shall be

furnished where required in these specifications, the Contract Specifications, or otherwise requested by the Engineer.

6-7 Local Materials

Local material is rock, sand, gravel, earth or other mineral material, other than local borrow or selected material, obtained or produced from sources in the vicinity of the work specifically for use on the project. Local material does not include materials obtained from established commercial sources. Local materials shall be furnished by the Contractor from any source the Contractor may elect, except that when mandatory local material sources of certain materials are designated in the special provisions, the Contractor shall furnish material from those designated mandatory sources.

The Contractor shall make all arrangements necessary to obtain materials from any local material source other than a mandatory local material source. If the Contractor elects to obtain material from any other non-mandatory source, the Contractor shall furnish the Engineer with satisfactory evidence that the Contractor has entered into an agreement with the property owner for obtaining material from that source and with copies of any necessary permits, licenses and environmental clearances before removing any material from those sources.

The furnishing of local materials from any source is subject to the provisions of Section 2-2, "Examination of Site of Work, Plans, Specifications and Contract Documents." Unless described in the Contract Specifications as a mandatory local material source, or approved in writing by the Engineer, material sources shall not be excavated at locations where the resulting scars will present an unsightly appearance from any street or highway. No payment will be made for material obtained in violation of this provision.

The Contractor shall, at the Contractor's expense, make any arrangements necessary for hauling over local public and private roads from any source. Local materials will be subject to the provisions of Section 6-8, “Samples and Tests.”

Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in conforming to the provisions in this Section 6-7, for furnishing and producing materials from any source shall be considered as included in the price paid for the contract item of work involving the material and no additional compensation will be allowed therefor. If there is no bid item for local materials, the cost shall be included in the various bid items of work; no additional payment will be made.

6-8 Samples And Tests

In accordance with Section 6-1, “Source of Supply and Quality of Materials,” 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 Contractor shall furnish and deliver 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.

Whenever a reference is made in these Standard Specifications to a specification, manual or test designation either of the ASTM, the AASHTO, Federal Specifications, or any other recognized national organization, and the number or other identification representing the year of adoption or latest revision is omitted, it shall mean the specification, manual or test designation in effect on the day the Notice Inviting Bids for the work is dated.

Whenever the specification, manual or test designation provides for test reports (such as certified mill test reports) from the manufacturer, copies of those reports, identified as to the lot of material, shall be furnished to the Engineer by the Contractor. The manufacturer's test reports shall supplement the inspection, sampling and testing provisions in this Section 6, and shall not constitute a waiver of the City's right to inspect. When material which cannot be identified with specific test reports is proposed for use, the Engineer may, at the Engineer's discretion, select random samples from the lot for testing. Test specimens from the random samples, including those required for retest, shall be prepared in accordance with the referenced specification and furnished by the Contractor at the Contractor's expense. The number of the samples and test specimens shall be entirely at the discretion of the Engineer. Unidentified metal products, such as sheet, plate and hardware shall be subject to the requirements of Section 55-2.07, "Unidentified Stock Material," of the State Standard Specifications.

When requested by the Engineer, the Contractor shall furnish, without charge, samples of all materials entering into the work, and no material shall be used prior to approval by the Engineer, except as provided in Section 6-5, "Certificates of Compliance." Samples of material from local sources shall be taken by or in the presence of the Engineer; otherwise, the samples will not be considered for testing.

All tests 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 prescribed in these Specifications.

Whenever the specifications require compliance with specified values for the following properties, tests will be made by the California Test indicated unless otherwise specified:

Properties	California Test
Relative Compaction	216 or 231
Sand Equivalent	217
Resistance (R-value)	301
Grading (Sieve Analysis)	202
Durability Index	229

Unless provided otherwise in the Specifications, the cost of original testing shall be borne by the City for work performed under Contract for the City. Any retesting required because of failure of materials to pass the initial test shall be done at the expense of the Contractor. All other tests required for work not under contract with the City, and located in City streets and alleys, or on private property, shall be borne by the Contractor, or permittee in the case of non-public work performed under a City Encroachment Permit.

6-9 Compaction Tests

Relative compaction of soil in trenches, embankment or structural backfill shall be determined by the laboratory standard of test procedure California Method 216, except that dry random sampling methods (dry weight basis testing) may be used. To be considered a "passing" test, all compaction tests must meet the required relative percent compaction and must indicate a moisture content within 2% ± of optimum. The Drive-Cylinder method (ASTM Designation D 2937), the Sand Cone Method (ASTM D1556), or other methods approved by the Engineer may be used for sampling of compacted soil. The Contractor's responsibility for costs associated with testing shall be in accordance with the provisions of Section 6-8, "Samples and Tests."

The contractor shall give notice to the Engineer two (2) working days in advance of when the required compaction tests are to be taken. Normally, the first series of tests will be taken at the expense of the City. Any further tests needed to check recompacted areas because of a failure to pass the original test shall be at the expense of the Contractor. The Engineer shall specify the locations where compaction tests are to be taken.

6-10 Guarantee Of Materials

The Contractor shall comply with the provisions in Sections 3-5, "Materials Statement, Samples and Guarantees," 5-23, "Guarantee of Workmanship," and 7-23, "Guarantee." The Contractor shall guarantee all materials, including landscape plantings and irrigation systems, equipment, and workmanship of the installation for a period of one year from the date of the Acceptance of the Work by the City Council. Additional guarantees may be required by the Contract Specifications. 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 Contract, including the Plans and Specifications, the Contractor shall be notified within the time period of the Guarantee, and shall immediately perform, at Contractor's expense, the necessary repairs or replacements to make the defective item or items suitable and satisfactory. Expiration of the Guarantee time period shall not void an obligation of the Contractor to repair or replace which is based on a timely notice by the City. Should exigencies be such as to necessitate the repairs before the Contractor could be notified, or should the Contractor refuse to make the repairs or replacements within a reasonable period of time, 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 failure.

All costs for providing guarantees shall be included in the various bid items; no additional payment will be made therefor.

6-11 Salvage Of Materials

Where salvage of material is indicated on the Plans or in the Contract Specifications, salvaged material shall remain the property of the City and shall be delivered and deposited by the Contractor at the location specified in the Plans, Contract Specifications, or by the Engineer. No separate payment will be made for such salvaging and delivering of material; the cost thereof shall be included in the various bid items of work.

6-12 Materials Hauling

Hauling of all materials to, from, or on, the jobsite shall be performed in strict accordance with the Clovis Municipal Code, Article 2, Traffic Administration, and California Vehicle Code (CVC) Section 23114 as it relates to covering, spillage, and other requirements. All references to "highway" in the CVC shall mean City streets as well as State highways.

SECTION 7 - LEGAL RELATIONS AND RESPONSIBILITY

7-1 Laws To Be Observed

The Contractor shall be and remain fully informed of all existing and future State and Federal laws, City and County ordinances and regulations, and revisions thereto that in any way affect those engaged or employed in or on the work or in any way affect the conduct of the work, and of all orders or decrees of governmental or other bodies or officials having jurisdiction or authority over the same. The Contractor, and all subcontractors, persons, firms or corporations employed by or under the control of the Contractor, shall at all times observe and comply with all such laws, ordinances and regulations, orders and decrees. The Contractor shall protect and indemnify the City and its officers, employees and agents, against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree whether by the Contractor, the Contractor's employees, subcontractors, persons, firms or corporations employed by the Contractor. If any discrepancy or inconsistency is discovered in the Plans or Specifications for the work in relation to any such law, ordinance, regulation, order or decree, the Contractor shall forthwith report the same to the Engineer in writing.

7-2 Labor Code Requirements

The following requirements of the State Labor Code apply to all City Contracts:

7-2(A) Hours Of Labor

Eight hours labor constitutes a legal day's work. The Contractor or any subcontractor under the Contractor shall forfeit, as a penalty to the State of California, twenty five dollars ($25) or such other amount as may be amended by the Department of Industrial Relations from time to time for each worker employed in the execution of the contract by the respective Contractor or subcontractor for each calendar day during which that worker is required or permitted to work more than 8 hours in any one calendar day and 40 hours in any one calendar week in violation of the requirements of the Labor Code, and in particular, Section 1810 to Section 1815, thereof, inclusive, except that work performed by employees of Contractors in excess of 8 hours per day, and 40 hours during any one week, shall be permitted upon compensation for all hours worked in excess of 8 hours per day at not less than one and one-half times the basic rate of pay, as provided in Section 1815 thereof.

7-2(B) Prevailing Wage

The Contractor and any subcontractor under the Contractor shall comply with Labor Code Sections 1774 and 1775. Pursuant to Section 1775, the Contractor and any subcontractor under the Contractor shall forfeit to the State or political subdivision on whose behalf a contract is awarded a penalty of not more than fifty dollars ($50), or such other amount as may be amended from time to time by the Department of Industrial Relations for each calendar day, or portion thereof, for each worker paid less than the prevailing rates as determined by the Director of Industrial Relations for the work or craft in which the worker is employed for any public (City) work done under the contract by the Contractor or by any subcontractor under the Contractor in violation of the requirements of the Labor Code and in particular, Labor Code Sections 1770 to 1780, inclusive. The amount of this forfeiture shall be determined by the Labor Commissioner and shall be based on consideration of the mistake, inadvertence, or neglect of the Contractor or subcontractor in failing to pay the correct rate of prevailing wages, or the previous record of the Contractor or subcontractor in meeting their respective prevailing wage obligations, or the willful failure by the Contractor or subcontractor to pay the correct rates of prevailing wages. A mistake, inadvertence, or neglect in failing to pay the correct rate of prevailing wages is not excusable if the Contractor or subcontractor had knowledge of the obligations under the Labor Code. In addition to the penalty and pursuant to Labor Code Section 1775, the difference between the prevailing wage rates and the amount paid to each worker for each

calendar day or portion thereof for which each worker was paid less than the prevailing wage rate shall be paid to each worker by the Contractor or subcontractor. If a worker employed by a subcontractor on a public works (City) project is not paid the general prevailing per diem wages by the subcontractor, the prime contractor of the project is not liable for the penalties described above unless the prime contractor had knowledge of that failure of the subcontractor to pay the specified prevailing rate of wages to those workers or unless the prime contractor fails to comply with all of the following requirements:

1. The contract executed between the contractor and the subcontractor for the performance of work on the public works (City) project shall include a copy of the requirements in Sections 1771, 1775, 1776, 1777.5, 1813 and 1815 of the Labor Code.
2. The contractor shall monitor the payment of the specified general prevailing rate of per diem wages by the subcontractor to the employees, by periodic review of the certified payroll records of the subcontractor.
3. Upon becoming aware of the subcontractor's failure to pay the specified prevailing rate of wages to the subcontractor's workers, the contractor shall diligently take corrective action to halt or rectify the failure, including, but not limited to, retaining sufficient funds due the subcontractor for work performed on the public works (City) project.
4. Prior to making final payment to the subcontractor for work performed on the public works (City) project, the contractor shall obtain an affidavit signed under penalty of perjury from the subcontractor that the subcontractor has paid the specified general prevailing rate of per diem wages to the subcontractor's employees on the public works (City) project and any amounts due pursuant to Section 1813 of the Labor Code.

Pursuant to Section 1775 of the Labor Code, the Division of Labor Standards Enforcement shall notify the Contractor on a public works (City) project within 15 days of the receipt by the Division of Labor Standards Enforcement of a complaint of the failure of a subcontractor on that public works (City) project to pay workers the general prevailing rate of per diem wages. If the Division of Labor Standards Enforcement determines that employees of a subcontractor were not paid the general prevailing rate of per diem wages and if the City did not retain sufficient money under the contract to pay those employees the balance of wages owed under the general prevailing rate of per diem wages, the contractor shall withhold an amount of moneys due the subcontractor sufficient to pay those employees the general prevailing rate of per diem wages if requested by the Division of Labor Standards Enforcement. The Contractor shall pay any money retained from and owed to a subcontractor upon receipt of notification by the Division of Labor Standards Enforcement that the wage complaint has been resolved. If notice of the resolution of the wage complaint has not been received by the Contractor within 180 days of the filing of a valid notice of completion or acceptance of the public works (City) project, whichever occurs later, the Contractor shall pay all moneys retained from the subcontractor to the City. These moneys shall be retained by the City pending the final decision of an enforcement action.

Pursuant to the requirements in Section 1773 of the Labor Code, the City has obtained the general prevailing rate of wages (which rate includes employer payments for health and welfare, pension, vacation, travel time and subsistence pay as provided for in Section 1773.8 of the Labor Code, apprenticeship or other training programs authorized by Section 3093 of the Labor Code, and similar purposes) applicable to the work to be done, for straight time, overtime, Saturday, Sunday and holiday work. The holiday wage rate listed shall be applicable to all holidays recognized in the collective bargaining agreement of the particular craft, classification or type of workmen concerned.

The general prevailing wage rates and any applicable changes to these wage rates are available at the office of the City Clerk, 1033 Fifth Street, Clovis, CA 93612. General prevailing wage rates are also available from the California Department of Industrial Relations' Internet Web Site at: http://www.dir.ca.gov.

The wage rates determined by the Director of Industrial Relations for the project refer to expiration dates. Prevailing wage determinations with a single asterisk after the expiration date are in effect on the date of advertisement for bids and are good for the life of the contract. Prevailing wage determinations with double asterisks after the expiration date indicate that the wage rate to be paid for work performed after this date has been determined. If work is to extend past this date, the new rate shall be paid and incorporated in the contract. The Contractor shall contact the Department of Industrial Relations as indicated in the wage rate determinations to obtain predetermined wage changes. Pursuant to Section 1773.2 of the Labor Code, general prevailing wage rates shall be posted by the Contractor at a prominent place at the site of the work.

Changes in general prevailing wage determinations which conform to Labor Code Section 1773.6 and Title 8 California Code of Regulations Section 16204 shall apply to the project when issued by the Director of Industrial Relations at least ten (10) days prior to the date of the Notice Inviting Bids for the project.

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 set forth in the contract. The possibility of wage increases is one of the elements to be considered by the Contractor in determining the bid, and will not under any circumstances be considered as the basis of a claim against the City on the contract.

7-2(C) Travel And Subsistence Payments

The Contractor shall make travel and subsistence payments to each workman, needed to execute the work, in conformance with the requirements in Labor Code Section 1773.8.

7-2(D) Payroll Records

The Contractor shall conform to the requirements in Labor Code Section 1776, a portion of which is quoted below. Regulations implementing Labor Code Section 1776 are located in Sections 16016 through 16019 and Sections 16207.10 through 16207.19 of Title 8, California Code of Regulations.

(a) Each contractor and subcontractor shall keep accurate payroll records, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the project for which a Contract is awarded by the City. Each payroll record shall contain or be verified by a written declaration that it is made under penalty of perjury, stating both of the following:

    (1) The information contained in the payroll record is true and correct.
    (2) The employer has complied with the requirements of Sections 1771, 1811, and 1815 for any work performed by his or her employees on the public works (City) project.

(b) The payroll records enumerated under subdivision (a) shall be certified and shall be available for inspection at all reasonable hours at the principal office of the contractor on the following basis:

(1) A certified copy of an employee's payroll record shall be made available for inspection or furnished to the employee or his or her authorized representative on request.
(2) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection or furnished upon request to a representative of the awarding body, the Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards of the Department of Industrial Relations.
(3) A certified copy of all payroll records enumerated in subdivision (a) shall be made available upon request by the public for inspection or for copies thereof. However, a request by the public shall be made through either the awarding body, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested payroll records have not been provided pursuant to paragraph (2), the requesting party shall, prior to being provided the records, reimburse the costs of preparation by the contractor, subcontractors, and the entity through which the request was made. The public shall not be given access to the records at the principal office of the contractor.

(c) The certified payroll records shall be on forms provided by the Division of Labor Standards Enforcement or shall contain the same information as the forms provided by the division.
(d) A contractor or subcontractor shall file a certified copy of the records enumerated in subdivision (a) with the entity that requested the records within 10 days after receipt of a written request.
(e) Any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the awarding body, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement shall be marked or obliterated in a manner so as to prevent disclosure of an individual's name, address and social security number. The name and address of the contractor awarded the contract or the subcontractor performing the contract shall not be marked or obliterated.
(f) The contractor shall inform the body awarding the contract of the location of the records enumerated under subdivision (a), including the street address, city and county, and shall, within five working days, provide a notice of a change of location and address.
(g) The contractor or subcontractor shall have 10 days in which to comply subsequent to receipt of a written notice requesting the records enumerated in subdivision (a). In the event that the contractor or subcontractor fails to comply within the 10-day period, he or she shall, as a penalty to the state or political subdivision on whose behalf the contract is made or awarded, forfeit twenty-five dollars ($25) (or such other amount as may be amended from time to time by the Department of Industrial Relations- added by City) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, these penalties shall be withheld from progress payments then due. A contractor is not subject to a penalty assessment pursuant to this section due to the failure of a subcontractor to comply with this section."

The penalties specified in subdivision (g) of Labor Code Section 1776 for noncompliance with the requirements in Section 1776 may be deducted from any moneys due or which may become due to the Contractor.

If required by the Engineer, a copy of all payrolls shall be submitted weekly to the Engineer. Payrolls shall contain the full name, address and social security number of each employee, the employee's correct classification, rate of pay, daily and weekly number of hours worked, itemized deductions made and actual wages paid. They shall also indicate apprentices and ratio of apprentices to

journeymen. The employee's address and social security number need only appear on the first payroll on which that name appears. The payroll shall be accompanied by a "Statement of Compliance" signed by the employer or the employer's agent indicating that the payrolls are correct and complete and that the wage rates contained therein are not less than those required by the contract. The "Statement of Compliance" shall be on forms furnished by the State or on any form with identical wording. The Contractor shall be responsible for the submission of copies of payrolls of all subcontractors.

If by the 15th of the month, the Contractor has not submitted satisfactory payrolls as requested by the Engineer for all work performed during the monthly period ending on or before the first of that month, the City will retain an amount equal to 10 percent of the estimated value of the work performed during the month from the next monthly estimate, except that this retention shall not exceed $10,000 nor be less than $1,000, or such other amount as may be determined from time to time by the State Department of Industrial Relations. Retentions for failure to submit satisfactory payrolls shall be additional to all other retentions provided for in the contract. The retention for failure to submit payrolls for any monthly period will be released for payment on the monthly estimate for partial payments next following the date that all the satisfactory payrolls for which the retention was made are submitted.

The Contractor and each subcontractor shall preserve their payroll records for a period of 3 years from the date of completion of the contract.

7-2(E) Labor Nondiscrimination

The Contractor shall comply with Section 1735 of the Labor Code, which reads as follows:

"No discrimination shall be made in the employment of persons upon public works because of the race, religious creed, color, national origin, ancestry, physical handicap, medical condition, marital status, or sex of such persons, except as provided in Section 12940 of the Government Code, and every contractor for public works violating this section is subject to all the penalties imposed for a violation of this chapter."

The Contractor shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the contract.

7-2(F) Apprentices

The Contractor and subcontractors shall comply with the provisions in Sections 1777.5, 1777.6 and 1777.7 of the California Labor Code and Title 8, California Code of Regulations Section 200 et seq. To ensure compliance and complete understanding of the law regarding apprentices, and specifically the required ratio thereunder, the Contractor and each subcontractor should, where some question exists, contact the Division of Apprenticeship Standards, 455 Golden Gate Avenue, San Francisco, CA 94102, or one of its branch offices prior to commencement of work on the contract. Responsibility for compliance with this section lies with the Contractor. It is State and City policy to encourage the employment and training of apprentices on public works contracts as may be permitted under local apprenticeship standards.

7-2(G) Workers' Compensation

Pursuant to the requirements in Section 1860 of the Labor Code, the Contractor will be required to secure the payment of workers' compensation to the Contractor's employees in conformance with the requirements in Section 3700 of the Labor Code and in accordance with the provisions of Section 7-4, “Contractor’s Insurance Requirements And Hold Harmless.”

7-2(H) Suits To Recover Penalties And Forfeitures
The Contractor is subject to Sections 1730 to 1733, inclusive, of the Labor Code concerning suits to recover amounts withheld from payment for failure to comply with requirements of the Labor Code or contract provisions based on those laws. Those sections provide that a suit on the Contract for alleged breach thereof in not making the payment is the exclusive remedy of the Contractor or the Contractor's assignees with reference to amounts withheld for those penalties or forfeitures; and that the suit must be commenced and actual notice thereof received by the awarding authority prior to 90 days after completion of the contract and the formal acceptance of the job. Submission of a claim pursuant to Section 9-10, "Final Payment," for the amounts withheld from payment for those penalties and forfeitures is not a prerequisite for those suits, and these claims will not be considered.

7-3 Contractor's Licensing Laws
All bidders and contractors shall be licensed in accordance with the laws of this State, specifically the provisions the Business and Professions Code, Division 3, Chapter 9. Any bidder or contractor not so licensed is subject to the penalties imposed by such laws.

In accordance with the requirements in Public Contract Code Section 10164, in all contracts where Federal funds are involved, the Contractor shall be properly licensed at the time the Contract is awarded.

7-4 Contractor's Insurance Requirements And Hold Harmless

Hold Harmless
The Contractor shall indemnify, defend, and hold harmless the City and its officers, officials, employees, agents, and volunteers from and against all claims, damages, losses, actions, suits, demands, liability, and expenses including attorney fees arising out of the performance of the work described herein, caused in whole or in part by any act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, except where caused by the active negligence, sole negligence, or willful misconduct of the City. The provisions of Section 7-1, "Laws to be Observed," Section 7-16, "Injury or Damage to Persons or Property," and Section 7-19, Patents," also apply.

Insurance Requirements For Contractors
The Contractor shall procure and maintain, for the duration of the contract, insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors.

The following insurance requirements are minimum, and may be amended by the Contract Specifications to include increased coverage limits and expanded coverage including Course of Construction (Builder's Risk) Insurance. The Course of Construction policy shall name the City as Loss Payee.

Minimum Scope of Insurance

Coverage shall be at least as broad as:

1. Insurance Services Office (ISO) Commercial General Liability coverage (occurrence Form CG 00 01) *or* ISO form (Form CG 00 09 11 88 Owners and Contractors Protective Liability Coverage Form – Coverage for Operations of Designated Contractor.

2. Insurance Services Office Form CA 00 01 covering Automobile Liability, Code 1 (any auto).
3. Workers' Compensation insurance as required by the State of California and Employer's Liability Insurance.
4. Builder's Risk (Course of Construction) insurance covering all risks of loss less policy exclusions.
5. Surety bonds as described below.
6. Professional Liability (if *Design/Build*).

Minimum Limits of Insurance

Contractor shall maintain limits no less than:

1.	General Liability: (Including operations, products and completed operations.) This coverage is to be maintained for 10 years after the completion of the Contract.	$5, 000,000 *	per occurrence for bodily injury, personal injury and property damage. If Commercial General Liability insurance or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit.
2.	Automobile Liability:	$1,000,000 *	per accident for bodily injury and property damage.
3.	Workers' Compensation:	As required by the State of California	
4.	Employer's Liability:	$1,000,000 *	per accident for bodily injury or disease.
5.	Builder's Risk (when required by the Contract Specifications):	Completed value of the project with no coinsurance penalty provisions.	
6.	Professional Liability:	$1,000,000 *	as needed for design/build. This coverage is to be maintained for 3 years after expiration of the Contract

*** These amounts are standard amounts and may vary by project. Unless otherwise specified in the Contract Specifications, the Contractor shall provide the coverage amounts above specified.**

Deductibles and Self-Insured Retentions

Any deductibles or self-insured retentions must be declared to and approved by the City. At the option of the City, either (a) the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the City, its officers, officials, employees and volunteers or (b) the Contractor shall provide a financial guarantee satisfactory to the City guaranteeing payment of losses and related investigations, claim administration, and defense expenses.

Other Insurance Provisions

The general liability and automobile liability policies are to contain, or be endorsed to contain, the following provisions:

1. The City, its officers, officials, employees, and volunteers are to be covered as insureds with respect to liability arising out of automobiles owned, leased, hired or borrowed by or on behalf of the contractor; and with respect to liability arising out of work or operations performed by or on behalf of the Contractor including materials, parts or equipment furnished in connection with such work or operations. General liability coverage can be provided in the form of an endorsement to the Contractor's insurance, or as a separate owner's policy.
2. For any claims related to this project, the Contractor's insurance coverage shall be primary insurance as respects the City, its officers, officials, employees, and volunteers. Any insurance or self-insurance maintained by the City, its officers, officials, employees, or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.
3. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be canceled by either party, except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to the City.
4. Coverage shall not extend to any indemnity coverage for the active negligence of the additional insured in any case where an agreement to indemnify the additional insured would be invalid under Subdivision (b) of Section 2782 of the Civil Code.

Acceptability of Insurers

Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A:VII, unless otherwise acceptable ~~by~~ to the City. ~~Only California admitted insurers may be used.~~ Insurance is to be placed only with California admitted insurers or insurers which are currently licensed by the State Insurance Commissioner, ~~and are~~ unless otherwise acceptable to the City.

Verification of Coverage

Contractor shall furnish the City with original certificates and endorsements, including amendatory endorsements, effecting coverage required by this clause. All certificates and endorsements are to be received and approved by the City before work commences; however, failure to do so shall not operate as a waiver of these insurance requirements. The City reserves the right to require complete, certified copies of all required insurance policies, including endorsements effecting the coverage required by these Specifications at any time.

Waiver of Subrogation

Contractor hereby agrees to waive subrogation which any insurer of contractor may acquire from contractor by virtue of the payment of any loss. Contractor agrees to obtain any endorsement that may be necessary to effect this waiver of subrogation.

The workers' compensation policy shall be endorsed to contain a waiver of subrogation in favor of the City for all work performed by the contractor, its agents, employees, independent contractors and subcontractors.

Subcontractors

Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverages for subcontractors shall be subject to all of the requirements stated herein.

Surety Bonds

The Contractor shall provide the following surety bonds: Bid Bond; Performance Bond; and Payment Bond, all in the amounts specified in Section 3-3, "Required Contract Securities, Insurance Certificates, Business License, Injury and Illness Prevention Plan."

All costs for compliance with this Section 7-4 shall be included in the various items of work. No separate payment will be made therefor.

7-5 Vehicle Code

Pursuant to the authority contained in Vehicle Code Section 591, the City has determined that within those areas that are within the limits of the project and are open to traffic, the Contractor shall comply with all the requirements set forth in Divisions 11, 12, 13, 14 and 15 of the Vehicle Code. In accordance with the statement in Vehicle Code Section 591, this section shall not relieve the Contractor or any person from the duty of exercising due care. The Contractor shall take all necessary precautions for safe operation of the Contractor's equipment and the protection of the public from injury and damage from the Contractor's equipment.

7-6 Air Pollution Control

For all projects, the Contractor shall comply with State air pollution control rules, regulations, ordinances and statutes which apply to any work performed pursuant to the contract, including any air pollution control rules, regulations, ordinances and statutes, specified in Section 11017 of the Government Code. The Contractor shall also comply with all of the requirements of Regulation VIII of the San Joaquin Valley Air Pollution Control District (APCD. It will be the Contractor's responsibility to contact the APCD to determine the requirements of said Regulation and any costs related to compliance therewith. All costs for compliance, including any permit fees, shall be included in the various items of work; no separate or additional payment will be made therefor. Reference is made to Section 7-10, "Permits and Licenses."

In addition to foregoing requirements, for projects specified in the Contract Specifications to be subject to Rule 9510 of the APCD, Contractors shall, before submitting a bid, contact the APCD and determine the project-specific requirements of said Rule. Any project-specific permit fee will be paid by the City. All other costs for compliance with the Rule 9510 requirements, including submittal of all required documentation during the life of the project, shall be included in the various items of work. No separate or additional payment will be made therefor. Reference is made to Section 7-10, "Permits and Licenses."

The Contractor shall also comply with the provisions in Section 10, "Dust Control."

7-7 Water Pollution Prevention

The Contractor shall exercise every reasonable precaution and shall conduct and schedule operations so as to protect all storm drain systems, storm water retention/detention basins, irrigation canals, or natural streams located within, adjacent to, or in any way connected with, the project from pollution with mud, silt, fuels, oils, bitumens, calcium chloride, pesticides, herbicides, and any other harmful materials. The Contractor shall conduct water pollution prevention on all contracts awarded by the City, but for projects of one (1) acre or greater, the following special requirements shall apply.

7-7(A) Storm Water Pollution Prevention Plan (SWPPP) Requirements

The following provisions are required for all construction contracts awarded by the City for sites one (1) acre in size or greater. Their purpose is to provide detailed instructions to contractors to ensure

that construction practices do not cause pollutant discharges to the above-described storm water conveyance/storage systems. Contractors are encouraged to use these or similar requirements in their contracts with subcontractors. The requirements are based upon Best Management Practices developed by the California Storm Water Quality Task Force as presented in the California Storm Water Best Management Practices Handbook-Construction Activity. The Fresno Metropolitan Flood Control District has developed a model Storm Water Pollution Prevention Plan (SWPPP). Whether or not such provisions are included in subcontracts, the Contractor is responsible for compliance by others retained by the Contractor in the performance of the Contract.

The goal of these requirements is to prevent as much as possible the pollution of storm water conveyance/storage systems by storm water runoff from construction sites by keeping storm water runoff containing pollutants out of drainage systems for sufficient time to reduce pollutant loads, reducing the exposure and discharge of materials and wastes to storm water, and by reducing erosion and sedimentation.

The work for which a Contract is awarded is subject to the provisions and requirements of the State General Construction Activity Storm Water Permit (General Construction Permit). The Contractor shall be responsible for complying with all General Construction Permit requirements, as adopted and enforced by the State Water Resources Control Board (SWRCB) in August 1999, including any future revisions to that permit. The Contractor shall indemnify, and hold harmless the City for failure to comply with any provision or requirement of the General Construction Permit.

To insure permit compliance, the Contractor is directed to the official web site for the California Storm-water Quality Association (CASQA) http://www.cabmphandbooks.com/Construction.asp. The Contractor can obtain copies of the State General Construction Permit, Notice of Intent (NOI) and Notice of Termination (NOT) forms, instructions for completing the forms, and a Model Construction Activities Storm Water Pollution Prevention Plan (SWPPP).

In summary, the Contractor shall be required to comply with the following permit requirements. These requirements include:

7-7(A)1 Preparation Of A NOI And Vicinity Map

Unless otherwise provided in the Contract Specifications, the City shall, at its expense, prepare and submit the executed NOI, map and permit fee to the SWRCB for General Construction Permit coverage prior to commencement of construction. The Contractor shall receive a copy of the executed NOI from the City.

7-7(A)2 Preparation Of A Storm Water Pollution Prevention Plan (SWPPP)

The Contractor shall prepare a SWPPP that is project specific. At a minimum the SWPPP must address: general project information; a construction activity schedule; pollutant sources and best management practices (BMPs); maintenance, inspection, and repair of BMPs; Contractor training; site stabilization; a post construction management plan an overall permit compliance plan, and certifications. The Contractor shall submit a draft SWPPP for review, approval, and certification by the City no later than two weeks after receipt of the Notice of Award.

Within 24 hours of approval by the City, the Contractor shall provide the City with a complete copy of the certified SWPPP. Any amendments to the SWPPP shall also be submitted to the City for review, approval and certification. Within 24 hours of approval, the Contractor shall provide the City with documentation and certification of such amendments.

7-7(A)3 Implementation Of SWPPP
The Contractor shall be responsible implementing and maintaining the SWPPP at all times throughout the entire construction site and for the duration of the project, including both dry and wet weather seasons. The Contractor shall maintain a copy of the SWPPP on-site for the duration of the contract, and shall prepare all required inspection, maintenance and training documentation with the SWPPP and shall provide same upon request by agency or City enforcement personnel.

7-7(A)4 Site Stabilization
All soil disturbed by the work shall stabilized by methods approved by the Engineer prior to terminating permit coverage.

7-7(A)5 Preparation Of NOT And Post Construction Storm Water Management Plan
Following completion of the construction project, the Contractor shall submit a completed Notice of Termination (NOT) and PCSWMP to the City for review, approval, and signature. Within 24 hours of approval, the Contractor shall provide the City with a final copy of the project's PCSWMP. The City shall submit the executed NOT to the Central Valley Regional Water Quality Control Board (RWQCB) for termination of General Construction Permit coverage.

7-7(B) Payment
Unless otherwise provided by the Contract Specifications, and with the exception of the NOI fee, all costs for compliance with this Section 7-7, including preparation of the SWPPP, all inspection and other required reports, documentation, training, preparation of the PCSWMP and NOT, and any and all work associated with the maintenance of BMPs, shall be included in the price bid therefor. If no bid item is provided, the cost shall be included in the various items of work; no separate payment will be made therefor.

7-8 Use Of Pesticides
The Contractor shall comply with all rules and regulations of the California Department of Food and Agriculture, the Department of Public Health, the Department of Industrial Relations and all other State, Federal or Local agencies which govern the use of pesticides required in the performance of the work on the contract. Pesticides shall include but shall not be limited to herbicides, insecticides, fungicides, rodenticides, germicides, nematocides, bactericides, inhibitors, fumigants, defoliants, desiccants, soil sterilants and repellents. Any substance or mixture of substances intended for preventing, repelling, mitigating, or destroying weeds, insects, diseases, rodents, or nematodes and any substance or mixture of substances intended for use as a plant regulator, defoliant or desiccant shall be considered a pesticide.

7-9 Payment Of Taxes
The contract prices paid for the work shall include full compensation for all taxes which the Contractor is required to pay, whether imposed by Federal, State or local government, including, without being limited to, Federal Excise Tax.

No tax exemption certificate nor any document designed to exempt the Contractor from payment of any tax will be furnished to the Contractor by the City as to any tax on labor, services, materials, transportation, or any other items furnished pursuant to the contract.

7-10 Permits And Licenses
Unless otherwise provided in the Contract Specifications, the Contractor shall procure all required permits and licenses and give all notice necessary and incidental to the due and lawful prosecution of the work. The Contractor shall secure any required permits from the appropriate agencies prior to

making any preliminary soil investigations in public street rights-of-way, and shall abide by the provisions of said permits.

The Contractor and all subcontractors must comply with the Business License provisions of Section 3-3, "Required Contract Securities, Insurance Certificate, Business License, Injury and Illness Prevention Plan."

For all non-public work, an Encroachment Permit is required from the City Engineering Division before any work in street or other City right of way is commenced. For public work for which a Contract has been awarded by the City, the Contractor must obtain an Encroachment Permit from the City Engineering Division, prior to commencing work unless otherwise specified by the Contract Specifications.

Satisfactory evidence of obtaining all required permits and licenses, including the Contractor's and subcontractors' business licenses, shall be submitted to the Engineer with the executed contract and other documents required by the Specifications. The Contractor shall abide by the conditions of said permits and licenses and perform all work governed by said permits and licenses in conformance therewith and as directed by the Engineer. Compliance with this Section 7-10 shall be precedent to, and a condition of, issuance of the "Notice to Proceed."

Except as provided in Section 7-6, "Air Pollution Control," relating to Rule 9510, and unless otherwise provided in the Contract Specifications, full compensation for all costs involved in procuring all permits and licenses as indicated herein, including all fees and charges therefor, shall be included in the amount bid for the various items of work; no separate payment shall be made therefor.

7-11 Sanitary Regulations

Necessary housing accommodations shall be provided by the Contractor 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. The accommodations shall be in approved locations properly screened from public observation and shall be maintained in a strictly sanitary manner. The Contractor shall obey and enforce all State, County, and City 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.

The cost of compliance with this Section 7-11 shall be included in the various bid items of work; no separate payment will be made therefor.

7-12 Safety Provisions; First Aid; Injury/ Illness Prevention Program

The Contractor shall comply with the provisions of the State Labor Code, Division 5, "Safety in Employment," the State Division of Occupational Safety and Health Construction Safety Orders and General Industry Safety Orders of Title 8, California Code of Regulations, as well as all other applicable laws, ordinances and regulations.

In compliance with State Labor Code Section 6708, the Contractor shall maintain adequate emergency first aid treatment for his employees sufficient to comply with the Federal Occupational Safety and Health Act of 1970 (Public Law 91-596).

In compliance with Labor Code Section 6401.7, the Contractor shall have established, implemented, and maintains an Injury and Illness Prevention Plan. The Contractor shall comply with Section 3-3,

"Required Contract Securities, Insurance Certificate, Business License, Injury and Illness Prevention Plan," for plan submittal requirements.

Except as provided in Sections 7-13, "Worker Protection From Toxic or Explosive Gases," 7-14, "Trenches and Excavations; Hazardous Waste," and 7-15, "Worker Protection From Caving Ground in Excavations," full compensation for all costs involved in providing job safety, worker protection, and emergency first aid treatment shall be included in the amounts bid for the various items of work; no separate payment will be made therefor.

7-13 Worker Protection From Toxic Or Explosive Gases; Confined Spaces Entry

In conformance with the provisions of the State Labor Code and the Safety Orders set forth in Section 7-12, "Safety Provisions; First Aid; Injury/Illness Prevention Program," 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 or suspected to exist in any above or below ground facilities whether newly constructed or existing, excavations, or other activities involved in the work. Detection and removal shall be accomplished by methods which comply with the regulations governing such detection and removal. The Engineer and the City Fire Department should be notified immediately after detection.

The Contractor shall also comply with the provisions of the California Code of Regulations Title 8 General Industry Safety Orders, Article 108, "Confined Spaces," whenever the contractor or any of his employees must enter a confined space, as defined in said Safety Orders, whether the confined space is new or existing.

The above requirements 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.

If the presence of toxic or explosive gases are due to the actions of the contractor, all costs for worker protection, detection, removal, or repairs are to be borne by the contractor. If the presence of toxic or explosive gases are the result of latent or other conditions outside the control of the Contractor, compensation will be paid in accordance with Section 4-10, "Changes." In the event of a dispute, nothing in this Section 7-13 shall free the contractor of the responsibility to immediately take the necessary actions to provide worker protection and to remove or repair the cause of the presence of toxic or explosive gases.

All costs for compliance with this Section 7-13 shall be included in the various bid items; no separate payment will be therefor.

7-14 Trenches And Excavations; Hazardous Waste

7-14.1 Trenches And Excavations 4 Feet Or Less In Depth Below The Surface

If the Contractor encounters conditions at the Site which are subsurface or otherwise concealed physical conditions, which differ materially from those indicated in the Contract Documents, or unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the Contractor shall be given to the City promptly before conditions are disturbed and in no event later than ten (10) days after first observance of the conditions. The City will promptly investigate such conditions, and if they differ materially and cause an increase or decrease in the Contractor's cost of, time required for, or performance of any

part of the Work, will recommend an equitable adjustment in the Contract Sum, Contract Time, or both. If the City determines that the conditions at the Site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the City shall so notify the Contractor in writing, stating the reasons. Claims by Contractor in opposition to such determination must be made within ten (10) days after the City has given notice of the decision. If the City and the Contractor cannot agree on an adjustment in the Contract Sum or the Contract Time, Contractor shall proceed pursuant to Section 4-12, "Notices, Change Orders, and Claims."

7-14.2 Trenches And Excavations Greater Than 4 Feet In Depth; Hazardous Waste

Pursuant to Section 7104 of the State Public Contract Code, whenever the work requires digging trenches or other excavations that extend deeper than four feet below the surface, the following provisions apply:

A. The contractor shall promptly, and before the following conditions are disturbed, notify the Engineer, in writing, of any:
   1. Material that the contractor believes may be material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.
   2. Subsurface or latent physical conditions at the site differing from those indicated by information about the site made available to bidders prior to the deadline for submitting bids.
   3. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.
B. The Engineer shall promptly investigate the conditions, and if he finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the work shall issue a change order in accordance with Section 4-10, "Changes."
C. In the event that a dispute arises between the Engineer and the Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the work, the Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all work to be performed under the Contract. The Contractor shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between the contracting parties.

The Contractor shall comply with the requirements in Section 5-12, "Disposal of Material Outside the Right of Way."

7-15 Worker Protection From Caving Ground In Excavations

The Title 8 Construction Safety Orders of the Division of Occupational Safety and Health shall apply to all excavations. In compliance with Sections 341 and 341.1 of Title 8, California Code of Regulations, and Section 6500 of the State Labor Code, for any trenches or excavations that are 5 feet or more in depth, the Contractor must obtain a permit from the State Division of Occupational Safety and Health. The permit may be either a Project Permit (project specific) or an Annual Permit. The contractor shall comply with all the requirements of the permit and those of the Safety Orders.

In addition to the above permit requirement, in compliance with the provisions of State Labor submit to the Engineer, in advance of any excavation, a detail plan showing the design Code Section 6705, for trenches or excavations five feet or more in depth, the contractor shall of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground

during the excavation of such trenches or excavations. If such plan varies from the shoring system standards of the State Division of Occupational Safety and Health, the plan shall be prepared, stamped and signed by a Civil or Structural Engineer registered in the State of California. Nothing in this subsection shall be deemed to allow the use of a shoring, sloping, or protective system less effective than that required by the DOSH Construction Safety Orders.

The requirements as above set forth by the State Division of Occupational Safety and Health and the State Labor Code for the provision of worker 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.

Payment for worker protection from caving ground in excavations during construction shall be made at the price bid therefor; no additional payment will be made. Payment shall include all materials, labor and equipment necessary to adequately brace, shore, shield or slope all excavations and trenches as required by and the Division of Occupational Safety and Health Title 8 Construction Safety Orders. Also included are any costs incurred by the Contractor in obtaining all required OSHA permits and preparing a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection as required by State Labor Code Section 6705.

If the bid item therefor is based on a lump sum amount, payment will be pro-rated on the basis of the ratio of completed length of trench or other excavation requiring Worker Protection to the total length of trench or other excavation requiring Worker Protection.

7-16 Injury Or Damage To Persons Or Property

Reference is made to Section 5-3, “Contractor’s Responsibility For The Work,” Section 5-9, “Preservation of Property,” Section 7-4, “Contractor’s Insurance Requirements and Hold Harmless,” and Section 7-16, “Injury or Damage to Persons or Property.” Neither the City Council, the Engineer, nor any other officer, authorized agent, employee or volunteer shall be personally responsible for any liability arising under the Contract. The Contractor shall indemnify and save harmless the City, the City Council, the Engineer, and all City Officers, Employees, agents and volunteers from any suits, claims, damages, losses, liability, demands, or actions brought by any person or persons for or on account of any injuries or damage sustained in or arising out of the construction of the Work or in consequence thereof. The City Council may retain as much of the money due the Contractor as shall be considered necessary until disposition has been made of such suits or claims for damages as aforesaid.

If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, any of the other party's employees or agents, or others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding ten (10) days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be made as provided in Section 4-12, Notices, Change Orders, and Claims.”

7-17 Public Convenience

This Section 7-17 defines the Contractor's responsibility with regard to convenience of the public and traffic in connection with the Contractor's operations. Section 7-18, "Public Safety," provides requirements relating to the Contractor's responsibility for the safety of the public. The provisions in Section 7-18 are in addition to the provisions in this Section 7-17, and the Contractor will not be

relieved of the responsibilities as set forth in Section 7-18 by reason of conformance with any of the provisions in this Section 7-17.

The Contractor shall adhere to the provisions of Section 4-14, “Detours,” and Section 12, "Traffic Control; Construction Area Traffic Control Devices," concerning traffic control requirements, flagging and traffic-handling equipment and devices used in carrying out the provisions in this Section 7-17 and said Section 7-18, and for provisions relating to the passage of traffic over or around the work by detours, and other traffic.

In the event of a suspension of the work, the provisions of Section 8-11, "Temporary Suspension of Work," will apply.

The Contractor shall so conduct operations as to offer the least possible obstruction and inconvenience to the public and shall have under construction no greater length or amount of work than can be prosecuted properly with due regard to the rights of the public. Unless otherwise provided in the Contract Specifications or approved by the Engineer, all public traffic shall be permitted to pass through the work with as little inconvenience and delay as possible. Where possible, traffic shall be routed on new or existing paved surfaces.

Existing traffic signals and highway lighting within the project area or affected by the work shall be kept in operation for the benefit of the traveling public during progress of the work. Unless otherwise provided in the Contract Specifications, the Contractor shall be responsible for routine maintenance of existing systems.

Construction operations shall be conducted in such a manner as to cause as little inconvenience as possible to abutting property owners. Convenient access to driveways, houses, and buildings along the line of the work shall be maintained and temporary approaches to crossings or intersecting streets shall be provided and kept in good condition. When the abutting property owner's access across the right of way line is to be eliminated, or to be replaced under the contract by other access facilities, the existing access shall not be closed until the replacement access facilities are usable. Spillage resulting from hauling operations along or across any public traveled way shall be removed immediately by the Contractor at the Contractor's expense.

Water or dust palliative shall be applied if ordered by the Engineer for the alleviation or prevention of dust nuisance as provided in Section 10, "Dust Control."

The Contractor will be contacted when a situation or condition is identified as a PUBLIC INCONVENIENCE. An appropriate response time will be granted (usually 24 hours). The contractor must resolve the issue within the response time granted. Liquidated damages will accrue at the rate of $250 per calendar day for each day beyond the resolution date that the situation remains unresolved. The City may, at its option, take corrective action following the expiration of the granted time. All costs incurred by the City for taking such corrective action, plus a $250 administrative fee, will be deducted from monies owed the Contractor or billed to the Contractor in the case of non-public work being done under permit.

The foregoing process shall apply to all Contracts awarded by the City and also to Encroachment Permits issued by the City to Contractors for non-public work. The provisions of Section 9-7, “Stop Notices; City’s Right to Withhold Payments,” will apply.

Full compensation for conforming to the provisions in this Section 7-17 shall be considered as included in the prices paid for the various contract items of work and no additional compensation will be allowed therefor.

7-18 Public Safety

The Contractor shall provide for the safety of traffic and the public during construction. The Contractor's attention is directed to the provisions of Section 7-4, "Contractor's Insurance Requirements and Hold Harmless," Section 7-16, "Injury or Damage to Persons or Property," and Section 7-17, "Public Convenience," relating to the Contractor's responsibility for providing for the convenience and safety of the public in connection with the Contractor's operations.

The provisions of Section 12, "Traffic Control; Construction Area Traffic Control Devices," concerning flagging and traffic-handling equipment and devices used in carrying out the requirements of Section 7-17, "Public Convenience," apply to this Section 7-18.

Whenever the Contractor's operations create a condition hazardous to traffic or to the public, the Contractor shall, at the Contractor's expense and without cost to the City, furnish, erect and maintain those fences, temporary railing (Type K), barricades, lights, signs and other devices and take such other protective measures that are necessary to prevent accidents or damage or injury to the public. Fences, temporary railing (Type K), barricades, lights, signs, and other devices furnished, erected and maintained by the Contractor, at the Contractor's expense, are in addition to any construction area traffic control devices for which payment is provided for elsewhere in these specifications.

The Contractor shall also furnish such flaggers as are necessary to give adequate warning to traffic or to the public of any dangerous conditions to be encountered, and payment therefor will be made as provided in Section 12, "Traffic Control; Construction Area Traffic Control Devices."

Signs, lights, flags, and other warning and safety devices and their use shall conform to the requirements set forth in Part 6 of the California MUTCD. Signs or other protective devices furnished and erected by the Contractor, at the Contractor's expense, as above provided, shall not obscure the visibility of, nor conflict in intent, meaning and function of either existing signs, lights and traffic control devices or any construction area signs and traffic control devices for which furnishing of, or payment for, is provided elsewhere in the specifications. Signs furnished and erected by the Contractor, at the Contractor's expense, shall be approved by the Engineer as to size, wording and location.

The installation of general roadway illumination shall not relieve the Contractor of the responsibility for furnishing and maintaining any of the protective facilities herein before specified.

All movements of workmen and construction equipment on or across lanes open to public traffic shall be performed in a manner that will not endanger public traffic and be in conformance with Section 7-5, "Vehicle Code."

When leaving a work area and entering a roadway carrying traffic, the Contractor's equipment whether empty or loaded shall in all cases yield to traffic.

No material or equipment shall be stored where it will interfere with the free and safe passage of public traffic, and at the end of each day's work and at other times when construction operations are suspended for any reason, the Contractor shall remove all equipment and other obstructions from that portion of the roadway open for use by public traffic.

Temporary facilities which the Contractor uses to perform the work shall not be installed or placed where they will interfere with the free and safe passage of public traffic. Temporary facilities which could be a hazard to public safety if improperly designed shall comply with design requirements specified in the contract for those facilities or, if none are specified, with standard design criteria or codes appropriate for the facility involved. Working drawings and design calculations for the temporary facilities shall be prepared and signed by an engineer who is registered as a Civil Engineer in the State of California and shall be submitted to the Engineer for approval pursuant to Section 4-4, "Working Drawings." The submittals shall designate thereon the standard design criteria or codes used. Installation of the temporary facilities shall not start until the Engineer has reviewed and approved the drawings.

Should the Contractor appear to be neglectful or negligent in furnishing warning devices and taking protective measures as above provided, the Engineer may direct attention to the existence of a hazard and the necessary warning devices shall be furnished and installed and protective measures taken by the Contractor at the Contractor's expense. Should the Engineer point out the inadequacy of warning devices and protective measures, that action on the part of the Engineer shall not relieve the Contractor from responsibility for public safety or abrogate the obligation to furnish and pay for these devices and measures.

In accordance with Section 5-8, “Emergency Availability” in the event a condition or situation develops either during or after normal work hours which requires the attention of the Contractor, the following process applies:

If the condition or situation presents a clear and imminent public hazard and is deemed by the Engineer to be an EMERGENCY, and in the event the Contractor fails to immediately respond the Engineer’s direction to correct the condition, or attempts to contact the after-hours emergency response personnel of the Contractor fail, or in the event contact is made and the Contractor is either unwilling or unable to respond in a timely manner to the condition or situation deemed an emergency by the Engineer, then the Engineer shall mobilize immediately the resources necessary to respond to the situation.

In the event a condition or situation is deemed by the Engineer to present a potential public hazard and is considered to be URGENT, and upon notification thereof by the Engineer to the Contractor the condition is not corrected within 3 hours, or in the event attempts to contact the after-hours emergency response personnel of the Contractor fail, or in the event contact is made and the Contractor is either unwilling or unable to respond within three hours of contact, then the condition or situation deemed a HAZARD will be upgraded to an EMERGENCY by the Engineer, and the appropriate measures as above provided will be taken.

Due care will be taken to effect only those measures necessary to remove the emergency or urgent condition or situation. The Contractor will be invoiced for all direct costs incurred by the City, plus an emergency response fee of $500 and an administrative fee of $250. Once additional resources are deployed by the Engineer to resolve the emergency, the Contractor may still participate to reduce the cost of the deployment by the Engineer. All costs incurred by the City for taking such corrective action will be deducted from monies owed the Contractor. Parties not under contract to the City but subject to these Standard Specifications will be billed for the City’s costs.

The foregoing process shall apply to all Contracts awarded by the City and also to Encroachment Permits issued by the City to Contractors for non-public work. The provisions of Section 9-7, “Stop Notices; City’s Right to Withhold Payments,” will apply.

Except as otherwise provided in this Section 7-18 or in the Contract Specifications, full compensation for conforming to all of the provisions in this Section 7-18 shall be considered as included in the prices paid for the various contract items of work and no additional compensation will be allowed therefor.

7-19 Patents

The Contractor shall be responsible for the use of patented materials, equipment, devices, or processes used on or incorporated in the work. The Contractor shall assume all costs arising from the use of patented materials, equipment, devices or processes used on or incorporated in the work, and agrees to indemnify and save harmless the City, the Engineer, and their duly authorized representatives, from all suits at law, losses, liability, demands, claims, or actions of every nature for, or on account of the use of any patented materials, equipment, devices or processes.

7-20 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 90 percent 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 being so attached or affixed or upon payment of 90 percent of the value of materials delivered to the site of the work or stored subject to or under the control of the City. As provided in Subsection 5-3, "Contractor's Responsibility For The Work," the Contractor shall care for and protect the work until final acceptance of the work by the City.

7-21 Amendments To Contracts

Each and every provision of law and clause required by law to be inserted in the Contract for the work to be done under the Specifications shall be deemed to be inserted therein, and the Contract shall be read and enforced as though it were included therein; 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 thereto, the Contract shall forthwith be physically amended to make such insertion.

7-22 Verbal Statements Not Binding

It is understood and agreed that the written terms and provisions of the Contract shall supersede all verbal statements of the Engineer or other representatives of the City and such statements shall not be effective, or be construed as entering into or forming a part of, or altering in any way whatsoever the written agreement.

7-23 Guarantee

Whether working under a City Contract or under Encroachment Permit for Utility, Communications, or private work, the Contractor shall guarantee the proper installation and performance of all equipment, facilities and materials installed, including all landscape plantings and irrigation systems, or work performed pursuant to the Plans, Contract Specifications, these Specifications, or City Encroachment Permit, for a period of one year from the date of the Acceptance of the Work by the City Council, or other period set forth in the Contract Specifications. Any failure of equipment, facilities, landscape planting, or workmanship prior to the end of the one-year or other specified period shall be repaired or corrected by the Contractor at his sole expense in accordance with instructions of the Engineer. The provisions of Sections 3-5, "Material Statement, Samples and Guarantees," 5-23, "Guarantee of Workmanship," and 6-10, "Guarantee of Materials," also apply.

SECTION 8 - PROGRESS AND PROSECUTION

8-1 Sequence And Progress Of The Work

Unless otherwise provided in the Contract Specifications, the Contractor shall direct the order and sequence of work and coordinate the construction of the several parts of the Contract to a successful completion as rapidly as possible. If the Engineer determines, at any time, that appliances used, or to be used, are insufficient or improper for securing the quality of work required or the required rate of progress, the Engineer may order the Contractor to increase efficiency, or to improve their character. 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 the obligation to secure the quality of work, or the rate of progress specified.

8-2 Assignment Of Contract

The Contractor shall not assign the Contract or any part thereof, without the approval of the City or without the consent of surety unless the surety has waived its rights to notice of assignment. Consent will not be given to any proposed assignment which would relieve the original Contractor or the Contractor's surety of their responsibilities under the contract. 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, firms, or corporation rendering such services or supplying materials, and all deductions provided for in the contract and particularly all monies withheld, whether assigned or not, shall be subject to being used by the City for the completion of the work in the event that the Contractor should be in default therein.

8-3 Subcontracting

Section 2-7, "Designation of Subcontractors," sets forth the requirement that any subcontractor who performs in excess of one half of one percent (1/2 %) of the original contract price, or in the case of a street project so designated by the City, one half of one percent (1/2 %) or $10,000, whichever is greater, shall be designated on the Bid Proposal Form. At the time of the pre-construction conference, the Contractor shall file with the Engineer a written statement showing the work to be subcontracted, the names of the subcontractors and the description of each portion of the work to be subcontracted.

In accordance with Section 4109 of the State Public Contract Code, subcontracting of any portion of the work in excess of one-half of one percent of the Contractor's total bid for which no subcontractor was designated in the original bid shall only be permitted in cases of public emergency or necessity. It will be the Contractor's responsibility to submit to the Engineer the facts constituting a public emergency or necessity. If approved by the Engineer, a finding in writing will made a part of the public record setting forth the City's decision and the reasons therefor.

The Contractor shall give personal attention to the fulfillment of the contract and shall keep the work under the Contractor's control. No subcontractor will be recognized as such, and all persons engaged in the work of construction will be considered as employees of the Contractor and the Contractor will be held responsible for their work, which shall be subject to the provisions of the contract and specifications. When a portion of the work which has been subcontracted by the Contractor is not being prosecuted in a manner satisfactory to the Engineer, the subcontractor shall be removed immediately on the requisition of the Engineer and shall not again be employed on the work. The Contractor shall be responsible for the coordination of all trades, subcontractors, and material handlers engaged in the work. Neither the City nor the Engineer will undertake to settle any differences between the Contractor and its subcontractors or between subcontractors.

Subcontracts shall include provisions that the contract between the City and the Contractor is part of the subcontract, and that all terms and provisions of the contract are incorporated in the subcontract. Subcontracts shall also contain certification by the subcontractor that the subcontractor is experienced in and qualified to do, and knowledgeable about, the subcontracted work. Copies of subcontracts shall be available to the Engineer upon written request, and shall be provided to the Engineer at the time any litigation against the City concerning the project is filed.

Pursuant to the provisions of Section 6109 of the Public Contract Code, the Contractor shall not perform work under the contract with a subcontractor who is ineligible to perform work on the project pursuant to Section 1777.1 or 1777.7 of the Labor Code.

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.

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

8-4 Preconstruction Conference

Prior to construction and when set forth in the Contract Specifications or at the discretion of the Engineer, a meeting will be called by the Engineer with the Contractor, subcontractors and interested agencies or parties affected by the work, to discuss the proposed work. The preconstruction meeting shall be the proper time and place for the Contractor to submit to the Engineer required documents including, as a minimum, the following:

Construction Schedule - Section 8-5
Traffic Management (Control) Plan - Section 12-2.01
Names of Superintendent - Section 5-7
Emergency Contact List - Section 5-8
Proposed Notice to Residents - Section 8-7
Temporary Easements - Section 5-11
Request for City Approved Water Source - Section 5-13

8-5 Construction Schedule

After notification of award and prior to start of any work, at the pre-construction conference the Contractor shall submit to the Engineer for acceptance his proposed construction schedule. Acceptance or lack of rejection by City of a proposed construction schedule shall not be deemed approval and shall not create responsibility on the part of the City for any defects or mistakes in the schedule. The Contractor bears sole responsibility for the accuracy, utility and reasonableness of the schedule. The construction schedule shall be in the form of a tabulation, chart, or graph and shall be in sufficient detail to show the chronological relationship of all activities of the project including, but not limited to, estimated starting and completion dates of various activities, (including early and late dates and float for each activity), procurement of materials, the critical path, and scheduling of equipment. The construction schedule shall be consistent in all respects with the time and order of work requirements of the Contract.

The Contractor shall submit an updated schedule on a monthly basis that includes an accurate as-built schedule and the current as-planned schedule. The Contractor shall submit its daily logs for the month with the updated schedule. Float shall be used by the parties on a “first come, first serve”

basis. If the Contractor desires to make a significant change in his method of operations after commencing construction, he shall submit to the Engineer a revised construction schedule in advance of beginning revised operations. If the Contractor's actual progress falls behind the scheduled progress, within seven (7) days of a City request the Contractor shall prepare and submit a recovery plan. The recovery plan must include a revised schedule that would recover the lost time and still complete the Work by the scheduled completion deadline. The recovery plan shall also list any additional costs that would be incurred by Contractor during implementation of the recovery plan. If the City directs Contractor to implement the recovery plan, then Contractor shall do so. If the Contractor believes that it is entitled to additional compensation (money or time) for implementing the recovery plan, then Contractor shall observe the Claims and change order procedures in Sections 4-10, "Changes," and 4-12, "Notices, Change Orders, and Claims."

All schedules submitted by the Contractor shall be certified as true and correct (using the general format of the certification form in said Section 4-12).

The Contractor may not maintain any Claim or cause of action against the City for damages incurred as a result of its failure or inability to complete the Work in a shorter period than established in the Contract. The parties stipulate that the period set forth in the Contract is a reasonable time within which to perform the Work.

8-6 Beginning Of Work

Unless otherwise provided in the Contract Specifications, the Contractor shall commence work under the contract within fifteen (15) calendar days after the date of the Notice to Proceed and shall diligently prosecute the same to completion within the time limit provided in the Contract Specifications. Should the Contractor begin work in advance of receiving the Notice to Proceed, as above provided, any work performed shall be considered as having been done at the Contractor's sole risk and as a volunteer and no payment is guaranteed for any such work performed.

8-7 Notice To Residents

Not less than two (2) calendar days nor more than five (5) calendar days prior to proceeding with the work in any given area, the Contractor shall notify in writing all residents and tenants directly affected by the construction work. Such notice shall provide the nature of the work, the approximate time for the completion of work, and any anticipated inconveniences. The notice shall be on the contracting firm's letterhead and shall be signed and shall include the project superintendent's name and telephone number. Prior to commencing work in each given area, the Contractor shall furnish the Engineer a copy of the notice given to residents and tenants and shall certify the date, location and method by which the notice was delivered. The Contractor shall also comply with the requirements of Section 12-2.01, "Traffic Control Plan; Notifications."

For every occurrence when property access, sewer service or water source is to be interrupted by the Contractor's work, the Contractor shall give written notice to all affected residents/tenants not less than two (2) calendar days nor more than five (5) calendar days prior to said interruption. The notice(s) shall be in addition to the initial notice to residents described above.

All costs for compliance with this Section 8-7 shall be included in the various bid items of work; no additional payment will be made therefor.

8-8 Time Of Completion

The Contractor shall complete all or any designated portion of the work called for under the contract in all parts and requirements within the time set forth in the Contract Specifications. The current controlling operation or operations (i.e., the critical path) is to be construed to include any feature of

the work (e.g., an operation or activity, or a settlement or curing period) considered at the time by the Engineer and the Contractor, which, if delayed or prolonged, will delay the time of completion of the contract.

For contracts whose completion schedule is based on working days, a working day is defined as any day, except as follows:

Saturdays, Sundays and legal holidays declared by the City;

Days on which the Contractor is prevented by inclement weather or conditions resulting immediately therefrom adverse to the current controlling operation or operations, as determined by the Engineer, from proceeding with at least 75 percent of the normal labor and equipment force engaged on that operation or operations for at least 60 percent of the total daily time being currently spent on the controlling operation or operations; or

Days on which the Contractor is prevented, by reason of requirements in the Contract Specifications, from working on the controlling operation or operations for at least 60 percent of the total daily time being currently spent on the controlling operation or operations.

Should the Contractor prepare to begin work at the regular starting time of any day on which inclement weather, or the conditions resulting from the weather, or the condition of the work, prevents the work from beginning at the usual starting time and the crew is dismissed as a result thereof and the Contractor does not proceed with at least 75 percent of the normal labor and equipment force engaged in the current controlling operation or operations for at least 60 percent of the total daily time being currently spent on the controlling operation or operations, the Contractor will not be charged for a working day whether or not conditions should change thereafter during that day and the major portion of the day could be considered to be suitable for those construction operations.

Determination that a day is a non-working day by reason of inclement weather or conditions resulting immediately therefrom, shall be made by the Engineer. The Contractor will be allowed fifteen (15) days from the issuance of the weekly statement of working days in which to file a written protest setting forth in what respects the Contractor differs from the Engineer; otherwise, the decision of the Engineer shall be deemed to have been accepted by the Contractor as correct. The Engineer will furnish the Contractor a weekly statement showing the number of working days charged to the contract for the preceding week, the number of working days of time extensions being considered or approved, the number of working days originally specified for the completion of the contract and the number of working days remaining to complete the contract and the extended date for completion thereof, except when working days are not being charged in conformance with the provisions in Section 8-11, "Temporary Suspension of Work," of these Specifications.

For contracts whose completion schedule is based on calendar days, a calendar day shall mean every day of the calendar, including weekends and holidays. Exclusions for inclement weather which prevents the Contractor from performing, as above provided for working days will be permitted unless otherwise specified in the Contract Specifications.

8-9 Liquidated Damages

It is agreed by the parties to the Contract that in case all the Work called for under the Contract is not complete before or upon expiration of the time limit as set forth in the Contract Specifications, damage will be sustained by the City. Since it is and will be impractical to determine the actual damage which the City will sustain in the event of and by reason of such delay, and since the delay

will cause incalculable inconvenience to the public, it is therefor agreed that the Contractor will pay to the City the sum indicated in the Contract Specifications for each and every calendar day's delay beyond the time prescribed to complete the Work; and the Contractor agrees to pay such sum as set forth in the Contract Specifications, and in case the same is 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. Liquidated damages will accrue without notice, and any failure by City to withhold for some or all of them shall not act as a waiver by City of its rights to later claim the liquidated damages. Any waiver of liquidated damages by the City must be express and in writing.

It is further agreed that in case the Work is not finished and completed in all parts and requirements within the specified time, the City shall have the right to extend or not to extend the time for completion as may seem best to serve the interest of the City. If the City decides to extend the time limit for the completion of the Contract, the City shall further have the right to charge to the Contractor, his heirs, assigns, or sureties, and to deduct from the final payment for the work all or any part, as the City may deem proper, of the actual cost of engineering, inspection, superintendence, and other overhead expenses 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 the final estimate shall not be included in such charges.

The Contractor shall not be assessed with liquidated damages, or the cost of engineering and inspection, during any delay in the completion of the work caused by acts of God or acts of the public enemy, the City, fire, epidemics, quarantine restrictions, strikes and freight embargoes, provided that the Contractor shall, within five (5) calendar days from the beginning of such delay, notify the Engineer in writing of the causes of delay; and the Engineer's finding of the facts thereon shall be final and conclusive.

No extension of time will be granted for a delay caused by a shortage of materials unless the Contractor furnishes to the Engineer documentary proof that the Contractor has made every effort to obtain the materials from all known sources within reasonable reach of the work in a diligent and timely manner, and further proof in the form of supplementary progress schedules, as required in Section 8-5 “Construction Schedule,” that the inability to obtain the materials when originally planned, did in fact cause a delay in final completion of the entire work which could not be compensated for by revising the sequence of the Contractor's operations. The term "shortage of materials," as used in this Section 8-9, shall apply only to materials, articles, parts or equipment which are standard items and are to be incorporated in the work. The term "shortage of materials," shall not apply to materials, parts, articles or equipment which are processed, made, constructed, fabricated or manufactured to meet the specific requirements of the contract. Only the physical shortage of material will be considered under these provisions as a cause for extension of time. Delays in obtaining materials due to priority in filling orders will not constitute a shortage of materials.

If the Contractor is delayed by the City in completion of the Work by reason of changes made under Section 4-10, “Changes,” by failure of the City to acquire or clear right of way, by Extra Work under Section 4-11, “Extra Work,” or by any act of the Engineer or of the City, not contemplated by the contract, an extension of time commensurate with the delay in completion of the work thus caused will be granted, provided that the Contractor shall notify the Engineer in writing of the causes of delay within 15 days from the beginning of the delay. The Engineer shall ascertain the facts and the extent of the delay, and the Engineer's findings thereon shall be final and conclusive.

Except for the additional compensation provided for in Section 8-10, "Right of Way Delays," and except as provided in Public Contract Code Section 7102, the Contractor shall have no claim for damage or compensation for any delay or hindrance.

It is the intention of the above provisions that the Contractor shall not be relieved of liability for liquidated damages or engineering and inspection charges for any period of delay in completion of the work in excess of that expressly provided for in this Section 8-9.

8-10 Right Of Way Delays

The City makes a diligent effort at securing a clear right of way for the performance of the work required by the contract. For some contracts, it is in the best interests of the City and/or the public to award a contract before all utility relocations, utility undergrounding, right of way purchases, removal of obstructions, relocation of underground facilities by others, or other potential causes of delay are removed. Where known, these will be shown on the Plans with the actions to be taken, and enumerated in the Contract Specifications. The City will make every effort to ascertain the approximate time required to clear the right of way and so indicate in the Contract Specifications. The contractor shall also make a diligent effort by contacting the owner/agency/company of the time expected to clear the right of way before submitting a bid. In so doing, the contractor shall include in his costs any delays that can be expected or result from such relocations or acquisitions. The Engineer may grant a time extension deemed warranted due to such delays, or may temporarily suspend the contract in accordance with Section 8-11, “Temporary Suspension of Work.” Section 7102 of the State Public Contract Code notwithstanding, no additional compensation will be paid for such delays.

If new and unforeseen right of way delays not contemplated before the award of the contract causes the Contractor to sustain a loss which could not have been avoided by the judicious handling of forces, equipment, and plant, there shall be paid to the contractor that amount that the Engineer may find to be a fair and reasonable compensation for that part of the Contractor’s actual loss that, in the opinion of the Engineer, was unavoidable. Payment will be determined on the basis of extra work on a force account basis, or as otherwise agreed to by and between the Engineer and the Contractor, in accordance with Section 4-11, “Extra Work.”

8-11 Temporary Suspension Of Work

The Engineer shall have the authority to suspend the Work wholly or in part for such period as City desires. The Contractor shall immediately obey such order of the Engineer to suspend the Work, and shall not resume the Work until ordered in writing by the Engineer.

In the event that a suspension of Work is ordered as provided above, and should that suspension be ordered by reason of the failure of the Contractor to carry out orders or to perform any provision of the contract; or by reason of weather conditions being unsuitable for performing any item or items of Work, which Work, in the sole opinion of the Engineer, could have been performed prior to the occurrence of the unsuitable weather conditions had the Contractor diligently prosecuted the Work when weather conditions were suitable; then Contractor shall not be entitled to compensation (money or time) for the suspension, and the Contractor, at the Contractor's expense, shall do all the work necessary to provide a safe, smooth, and unobstructed passageway through construction for use by traffic during the period of that suspension as provided in Sections 7-17, "Public Convenience," and 7-18, "Public Safety," and as specified in the Contract Specifications. In the event that the Contractor fails to perform the Work above specified, the City may perform that Work and the cost thereof will be deducted from moneys due or to become due the Contractor.

In the event that a suspension of Work is ordered by the Engineer due to unsuitable weather conditions, and in the sole opinion of the Engineer, the Contractor has prosecuted the Work with energy and diligence prior to the time that operations were suspended, the cost of providing a smooth and unobstructed passageway through the Work will be paid for as Extra Work as provided in Section 4-11, "Extra Work," or at the option of the Engineer, that Work will be performed by the City at no cost to the Contractor. If the Engineer orders a suspension of all of the Work or a portion of the Work which is the current controlling operation (i.e., critical path) due to unsuitable weather conditions, and in the sole opinion of the Engineer, the Contractor has prosecuted the Work with energy and diligence prior to the time that operations were suspended, then Contractor shall be entitled to a time extension for the period of the suspension. If the portion of Work suspended is not a current controlling operation or operations, but subsequently does become the current controlling operation or operations, the determination of time extension will be made on the basis of the then current controlling operation or operations.

If a suspension of Work is ordered by the Engineer, due to the failure on the part of the Contractor to carry out orders given or to perform any provision of the contract, the days on which the suspension order is in effect shall be considered for time extension only if permitted under Section 8-8, "Time of Completion."

8-12 Use Of Completed Portions; City's Right To Complete

The City shall have the right to take possession of, use, or maintain and protect any completed portions of the Work. However, such possession, use, or maintenance and protection shall not be deemed as accepting any Work, regardless of whether it has or has not been completed in accordance with the Contract documents.

The City has the right to perform some or all of the Contractor's remaining Work if the Contractor fails or refuses to carry out the Work in accordance with the Contract Documents. The City may exercise this right at any time during the Contractor's work, including the closeout or punch list phases. The City shall first provide written notice to Contractor of Contractor's failure or refusal to perform in accordance with the Contract Documents, and such notice shall demand commencement or correction of such failure or refusal to perform within a reasonable time not to be less than seven (7) days. Such notice need not specifically refer to this provision.

If the Contractor fails to commence correction within said reasonable time, or ever fails to continue correction after expiration of said reasonable time, the City may instruct Contractor to stop performing such Work and notify Contractor that City shall perform such Work itself. Any direction to Contractor to not perform such Work shall act as a deletion of such Work from Contractor's scope of Work, and City may accept the Contractor's remaining contractual scope of Work as complete (pursuant to Section 8-14, "Acceptance of Contract") even though the deleted Work may not have been performed yet by City. City may perform the deleted Work at any time by whatever reasonable method the City may deem expedient without prejudice to other remedies the City may have. In the event the City takes bids to complete the Work so deleted, Contractor shall not be eligible for the award of the contract.

The Contractor will be invoiced all of the City's costs of performing the deleted Work, including compensation for additional professional and internally generated services and expenses made necessary by such deletion. The City may withhold the estimated costs from any retention release and/or progress payments due the Contractor, pursuant to Section 9-7, "Stop Notices; City's Right to Withhold Payments." If retention and payments withheld then or thereafter due the Contractor are not sufficient to cover the City's actual costs of completing the deleted Work, the Contractor shall pay the difference to the City.

Prior to performing any of the deleted work itself, City may, at its option, tender completion of the work to the Contractor's surety for completion by someone other than Contractor.

8-13 Termination Of Contract

If the Contractor files for bankruptcy; if the Contractor makes a general assignment for the benefit of his creditors; if a receiver should be appointed on account of the Contractor's insolvency; if the Contractor or any subcontractors should violate any of the provisions of the Contract; if the Contractor should refuse or should fail, except in cases for which extension of time is provided, to supply enough skilled workmen or proper materials; if the Contractor should fail to make prompt payment to subcontractors or for material or labor; or if the Contractor should disregard laws, ordinances or the instructions of the Engineer, the City may serve written notice upon the Contractor and its surety of the City's intention to terminate the Contract, such notice to contain the reasons for such intention to terminate the Contract and to provide five (5) calendar days for the Contractor to cure such violations and make satisfactory arrangements for correction thereof. In the case of filing for bankruptcy, the Contractor agrees that by entering this Contract it also stipulates that the bankruptcy court may grant relief to the City from any automatic stay as to this Contract (and as to any escrow agreement) so that City may proceed pursuant to this provision and terminate the contract if necessary. If within five (5) calendar days after the serving of the notice of intent to terminate, such violations do not cease and satisfactory arrangements for correction thereof are not made, then the City may, at its discretion, terminate the Contract at any time thereafter.

In the event of any such termination, the City shall immediately serve written notice thereof upon the Contractor and its surety; and the surety shall have the right to take over and perform the Contract, provided, however, that if the surety within ten (10) calendar days after the serving upon it of notice of termination does not give City written notice of its intention to take over and perform the Contract or does not commence performance thereof within the ten (10) calendar days stated above from the date of the serving of such notice of termination, 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 its surety, and the Contractor and its surety shall be liable to the City for any excess cost incurred by the City. 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 therefor. 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 and its surety 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.

The City may, at any time, terminate the Contract for the City's convenience and without cause. Upon receipt of written notice from the City of such termination for the City's convenience, the Contractor shall (1) cease operations as directed by the City in the notice; (2) take actions necessary, or that the City may direct, for the protection and preservation of the Work; and (3) except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders. The Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, but not overhead and profit on the Work not executed.

Any termination by City under this Section 8-13, or suspension by City under Section 8-11, "Temporary Suspension of the Work," shall not act as a waiver of any claims by City against Contractor or others for damages based on breach of contract, negligence or other grounds.

Contractor does not have the right to terminate the Contract or to suspend or slow down its performance of the Work. If Contractor believes that it is entitled to additional compensation (money and/or time) for any reason, or that it has been wronged for any reason, then it may submit a request for additional compensation and/or modification of the Contract; however, despite such requests as Contractor may make or disputes as may exist, Contractor shall continue to diligently prosecute the Work, and acceptably perform the Work, as required by the Contract through completion.

8-14 Acceptance Of Contract

When the Engineer has made the final inspection as provided in Section 5-22, "Final Inspection," and determines that the Work has been fully performed, the Engineer will certify the Work as ready for Acceptance and recommend that the City Council formally accept the Work, and immediately upon and after the Acceptance of the Work by the City Council, the Contractor will be relieved of the duty of maintaining and protecting the work as a whole, and the Contractor will not be required to perform any further work thereon except for warranty work; and the Contractor shall be relieved of the responsibility for injury to persons or property or damage to the work which occurs after the formal Acceptance by the City Council. Within ten (10) days of Acceptance by the City Council, the City shall record a Notice of Completion with the Fresno County recorder's office.

Acceptance of any Work shall not be deemed a waiver of the City's rights to remedy by the Contractor of (a) defective Work covered by warranty or guarantee for which the City gives timely notice to Contractor, and (b) latent defects resulting from defective materials or workmanship discovered after the City's recording of its Notice of Completion.

8-15 Utility And Non-Street Facilities; Potholing

Attention is directed to Sections 4-6, "Existing Facilities and Structures Shown on Plans," and 5-9, "Preservation of Property." The Contractor shall protect from damage utility and other non-street facilities that are to remain in place, or to be installed, relocated or otherwise rearranged. As used in this Section 8-15, "non-street facilities" means any above or below ground facilities which are not a part of the roadway structural section, curb and gutter, and sidewalk. Utility shall include sewer, water, recycled water, storm drain, and irrigation pipelines, above and below ground electrical and gas facilities, cable or other communications facilities.

It is anticipated that some or all of the utility and other non-street facilities, both above ground and below ground, that are required to be rearranged (as used herein, rearrangement includes installation, relocation, alteration or removal) as a part of the street improvement will be rearranged in advance of construction operations. Where it is not anticipated that the rearrangement will be performed prior to construction, or where the rearrangement must be coordinated with the Contractor's construction operations, the existing facilities that are to be rearranged will be indicated on the plans or in the Contract Specifications. Where a rearrangement is indicated on the plans or in the Contract Specifications, the Contractor will have no liability for the costs of performing the work involved in the rearrangement unless the Plans or Contract Specifications indicate such rearrangement is to be performed by the Contractor.

The right is reserved to the City and the owners of facilities, or their authorized agents, to enter upon the street right of way for the purpose of making those changes that are necessary for the rearrangement of their facilities or for making necessary connections or repairs to their properties. In compliance with Section 5-15, "Cooperation," the Contractor shall cooperate with forces engaged in this work and shall conduct operations in such a manner as to avoid any unnecessary delay or hindrance to the work being performed by the other forces. Wherever necessary, the work of the Contractor shall be coordinated with the rearrangement of utility or other non-street facilities, and the

Contractor shall make arrangements with the owner of those facilities for the coordination of the work.

The Contractor shall be aware of the possible existence of underground main or trunk line facilities not indicated on the Plans or in the Contract Specifications and to the possibility that underground main or trunk lines may be in a location different from that which is indicated on the Plans or in the Contract Specifications. **Prior to commencing any trenching, excavation, or boring operations, or any work that may damage any of the facilities or interfere with their service. the Contractor shall, by potholing or other means approved by the Engineer**, **ascertain the exact location of underground main or trunk line facilities whose presence is indicated on the Plans or in the Contract Specifications, the location of their service laterals or other appurtenances, and of existing service lateral or appurtenances of any other underground facilities which can be inferred from the presence of visible facilities such as buildings, meters and junction boxes, or manholes**.

If the Contractor cannot locate an underground facility whose presence is indicated on the Plans or in the Contract Specifications, the Contractor shall so notify the Engineer in writing. If the facility for which the notice is given is in a substantially different location from that indicated on the plans or in the special provisions, the additional cost of locating the facility will be paid for as extra work as provided in Section 4-11, "Extra Work."

If the Contractor discovers underground main or trunk lines not indicated on the plans or in the Contract Specifications, the Contractor shall immediately give the Engineer, and the Utility Owner if not the City, written notification of the existence of those facilities. The main or trunk lines shall be located and protected from damage as directed by the Engineer, and the cost of that work will be paid for as extra work as provided in said Section 4-11. The Contractor shall, if directed by the Engineer, repair any damage which may occur to the main or trunk lines. The cost of that repair work, not due to the failure of the Contractor to exercise reasonable care, will be paid for as extra work as provided in said Section 4-11. Damage due to the Contractor's failure to exercise reasonable care shall be repaired at the Contractor's cost and expense.

Where it is determined by the Engineer that the rearrangement of an underground facility is essential in order to accommodate the street or underground improvement and the Plans and Specifications do not provide that the facility is to be rearranged, the Engineer will provide for the rearrangement of the facility by other forces or the rearrangement shall be performed by the Contractor and will be paid for as extra work as provided in said Section 4-11. Alternatively, the Engineer may direct the rearrangement of the street or underground improvement if movement of the underground facility is not essential.

Should the Contractor desire to have any rearrangement made in any utility facility, or other improvement, for the Contractor's convenience in order to facilitate the Contractor's construction operations, which rearrangement is in addition to, or different from, the rearrangements indicated on the Plans or in the Contract Specifications, the Contractor shall make whatever arrangements are necessary with the owners of the utility or other non-street facility for the rearrangement and bear all expenses in connection therewith.

The Contractor shall immediately notify the Engineer of any delays to the Contractor's operations as a direct result of underground main or trunk line facilities which were not indicated on the Plans or in the Contract Specifications or were located in a position substantially different from that indicated on the Plans or in the Contract Specifications, or as a direct result of utility or other non-highway facilities not being rearranged as herein provided (other than delays in connection with

rearrangements made to facilitate the Contractor's construction operations or delays due to a strike or labor dispute). These delays will be considered right of way delays within the meaning of Section 8-10, "Right of Way Delays," and compensation for the delay will be determined in conformance with the provisions in said Section 8-10. The Contractor shall be entitled to no other compensation for that delay.

Any delays to the Contractor's operations as a direct result of utility or other non-highway facilities not being rearranged as provided in this Section 8-15, due to a strike or labor dispute, will entitle the Contractor to an extension of time as provided in Section 8-9, "Liquidated Damages." The Contractor shall be entitled to no other compensation for that delay.

Potholes or other excavations performed to determine the location of Utility and Non-Street Facilities, and which potholes or excavations will remain outside the area to be excavated for improvements shown on the Plans or specified in the Contract Specifications, shall be backfill, compacted, and the surface thereof restored in accordance with Section 19-3, “Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration.” Exception: Potholes or other excavations of diameter (or equivalent dimension if non-circular), of 9 inches or less, or any other pothole or excavation because of depth, shape, or other cause determined by the Engineer not to be feasible to apply the methods of said Section 19-3, shall be backfilled in accordance with the following manner: The bottom 1 foot of the pothole or other excavation shall be backfilled with clean sand; the remainder of the pothole or other excavation shall be backfilled with slurry cement conforming to Section 19-3.062, “Slurry Cement Backfill,” of the State Standard Specifications. The type of surface restoration for such locations shall be directed by the Engineer.

SECTION 9 - MEASUREMENT AND PAYMENT

9-1 Measurement Of Quantities

A. All work to be paid for at a contract price per unit of measurement will be measured by the Engineer in accordance with the U.S. Customary Units of Measurement. A ton shall consist of 2,000 pounds avoirdupois.

B. Quantities of work shall be determined from measurements or dimensions in horizontal planes. However, linear quantities of pipe, piling, fencing, and timber shall be considered as being the true length measured along the longitudinal axis.

C. Volumetric quantities will be determined by the Engineer, and shall be the product of the mean area or vertical or horizontal sections and the intervening horizontal or vertical dimension.

When payment is to be made on the basis of weight, the weighing shall be done on scales furnished by and at the expense of the Contractor, or on other sealed scales regularly inspected by the State of California, Department of Food & Agriculture, Division of Measurements & Standards, or its designated representative. All scales shall be suitable for the purpose intended and shall conform to the Specifications of the State of California, Department of Food & Agriculture, Division of Measurements & Standards. The scales shall be operated by a weigh-master licensed in accordance with the provisions of the California Business and Professions Code. The Contractor shall furnish a Public Weighmaster's certificate, or a Private Weigh-master's certificate of certified daily summary weight sheets. The operator of each vehicle shall obtain a weight or load slip from the weigher and deliver said slip to the Engineer at the point of delivery of the material.

Other materials and items of work which are to be paid for on the basis of measurement shall be measured in accordance with the methods stipulated in these Specifications, or the Contract Specifications for the particular items involved.

Full compensation for all expense involved in conforming to the requirements specified for measuring and weighing materials shall be considered as included in the unit price paid for the materials being measured or weighed and no additional compensation will be allowed therefor.

9-2 Cost Breakdown

Upon request of the Engineer, the Contractor shall submit, in a form acceptable to the Engineer, a schedule showing the subdivision of lump sum bid prices, into their various parts, stating quantities and prices for each part, to be made a basis for checking or computing monthly estimates, if such partial payments for lump sum items are specified. The prices shall include all costs of each item. The schedule of values shall be balanced and shall not shift excessive portions of the contract price into any particular part of the Work, especially parts of the Work being performed earlier in the schedule. No partial payment will be made to the Contractor until such schedule has been submitted to and approved by the Engineer, if required by him.

9-3 Final Pay Items

When an item of work is designated as (F) or (S-F) in the Engineer's Estimate, or is otherwise indicated in the Contract Specifications as a Final Pay Item, the estimated quantity for that item of work shall be the final pay quantity, unless the dimensions of any portion of that item are revised by the Engineer, or the item or any portion of the item is eliminated. If the dimensions of any portion of the item are revised, and the revisions result in an increase or decrease in the estimated quantity of that item of work, the final pay quantity for the item will be revised in the amount represented by the changes in the dimensions. If a final pay item is eliminated, the estimated quantity for the item will

be eliminated. If a portion of a final pay item is eliminated, the final pay quantity will be revised in the amount represented by the eliminated portion of the item of work.

The estimated quantity for each item of work designated as (F) or (S-F) or indicated otherwise as a final pay item in the Engineer's Estimate shall be considered as approximate only, and no guarantee is made that the quantity which can be determined by computations, based on the details and dimensions shown on the plans, will equal the estimated quantity. No allowance will be made in the event that the quantity based on computations does not equal the estimated quantity.

In case of discrepancy between the quantities shown in the Engineer's Estimate for a final pay item and the quantity or summation of quantities for the same item shown on the Plans, payment will be based on the quantity shown in the Engineer's Estimate.

9-4 Scope Of Payment

The Contractor shall accept the compensation provided in the Contract as full payment for furnishing all labor, materials, tools, equipment, and incidentals necessary to the completed Work, for performing all Work contemplated and embraced under the Contract; also for loss or damage arising from the nature of the Work, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the Work until the acceptance by the City and for all risks of every description connected with the prosecution of the Work; also for the expenses incurred in consequence of the suspension or discontinuance of the Work as provided in the Contract; and for completing the Work according to the Plans and Specifications. Neither the payment of any estimate nor of any retained percentage shall relieve the Contractor of the obligation to make good any defective work or material.

No compensation will be made in any case for loss of anticipated profits.

The lump sums and/or unit prices shown in the bid 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 all items delineated in the Contract documents for which specific bid items are not set up in the bid proposal. The Contractor shall proportionally spread all incidental costs associated with the work for which there are no separate bid items into the amount bid for those items of work for which there are bid items, and no separate or additional payment will be made for any requirement of the Contract not specifically listed on the bid proposal.

9-5 Payment For Extra Work

Extra Work as defined in Section 4-11, “Extra Work,” when ordered and accepted, shall be paid for under a written contract change 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 City, or on a force account basis.

When extra work is to be paid for on a force account basis, the Contractor shall be compensated in accordance with the provisions of Section 9-1.03, “Force Account Payment,” of the State Standard Specifications. Any references therein to “State” or “Department” shall mean “City.” References in said Section 9-1.03 to Section 9-1.06, “Partial Payments,” shall mean Section 9-6, “Partial (`Progress’) Payments and Retentions,” of these Standard Specifications.

If the Contractor and the City cannot agree on the force account price to be paid for Extra Work, or if the Contractor and the City cannot agree that certain work is Extra Work, then the Contractor shall

follow the claim and change order procedures of Sections 4-10, "Changes," and 4-12, "Notices, Change Orders, and Claims."

Payment as provided herein shall constitute full compensation to the Contractor for performance of Extra Work, and no additional compensation will be allowed therefor.

9-6 Partial ("Progress") Payments And Retentions

By the twentieth day of each month, the Contractor shall, on forms approved by the Engineer, furnish the Contractor's estimate of work completed prior to that date based on the schedule of values submitted by the Contractor pursuant to Section 9-2, "Cost Breakdown." The estimate and application must include the Contractor's previous month's daily logs and updated monthly schedule, or the City has the right to reject it. For materials delivered to the site and which are eligible for partial payment, the amount of any material to be considered in making an estimate will in no case exceed the amount thereof which has been reported by the Contractor to the Engineer on forms approved by the Engineer properly filled out and executed, including accompanying documentation as therein required, less the amount of the material incorporated in the work to the time of the estimate. Only materials to be incorporated in the work will be considered. The estimated value of the material established by the Engineer will in no case exceed the contract price for the item of work for which the material is furnished. Payment requests submitted after the 20th day of the month will not be processed for payment in the following month, but will be processed for payment in the next succeeding monthly payment period, when such payment will become due and payable.

The Engineer shall review, and revise if necessary, the Contractor's progress payment application. If the City determines that the application is not a proper payment request, the City shall return it to Contractor as soon as practicable with an explanation of why it is not proper, but not later than seven (7) days after receipt. If the Contractor and City cannot agree on the amount of work performed or other aspects of the application, then the Contractor shall resubmit using the Engineer's version. (If the Contractor feels that it should be paid more, it may follow the claims process under Section 4-12, "Notices, Change Orders, and Claims.") The City shall make the payment within thirty (30) days of the Contractor's submittal of an undisputed and properly submitted payment application.

The City shall retain five (5) percent of the estimated value of the work done and five (5) percent of the value of materials so estimated to have been furnished and delivered and unused as part security for the fulfillment of the contract by the Contractor. At the discretion of the Engineer, at any time after fifty (50) percent of the work has been completed, if the Engineer finds that satisfactory progress is being made, the City may reduce the amount retained from any of the remaining partial progress payments in accordance with Section 9203 of the State Public Contract Code.

The City shall pay monthly to the Contractor, while carrying on the Work, the balance not retained, as aforesaid, after deducting therefrom all previous payments and all sums to be kept or retained under the provisions of the Contract. No monthly 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. No monthly estimate or payment shall be construed to be an acceptance of any defective work or improper materials. Attention is directed to the prohibitions and penalties pertaining to unlicensed contractors as provided in Business and Professions Code Sections 7028.15(a) and 7031.

9-7 Stop Notices; City's Right To Withhold Payments

In addition to the five (5) percent withheld pursuant to Section 9-6, "Partial ('Progress') Payments and Retentions," the City may withhold or nullify the whole or any part of any partial or final progress payment or any release of retention, 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) Failure of the Contractor to make proper payments for labor, material, equipment, other facilities, or to subcontractors;

(c) Any penalties provided in these Standard Specifications for failure of the Contractor to carry out specific orders of the Engineer.

(d) Stop Notices pursuant to Civil Code section 3186, unless the Contractor at its sole expense provides a bond or other security satisfactory to the City in the amount of at least one hundred twenty-five percent (125%) of the claim, in a form satisfactory to the City, which protects the City against such claim. Any stop notice release bond shall be executed by a California admitted, fiscally solvent surety, completely unaffiliated with and separate from the surety on the payment and performance bonds, that does not have any assets pooled with the payment and performance bond sureties. The City may also withhold for the estimated reasonable cost of stop notice litigation to be incurred. For any stop notice resolved and/or released, the City may withhold for any reasonable cost of litigation actually incurred for that stop notice;

(e) Liquidated damages against the Contractor, whether already accrued or estimated to accrue in the future;

(f) Reasonable doubt that the Work can be completed for the unpaid balance of any Contract Sum or by the completion date;

(g) Damage to the property or work of the City, another contractor, or subcontractor;

(h) Unsatisfactory prosecution of the Work by the Contractor, and/or failure to perform all required Work;

(i) Failure to store and properly secure materials;

(j) Failure of the Contractor to submit on a timely basis, proper and sufficient documentation required by the Contract Documents, including, without limitation, monthly progress schedules, shop drawings, submittal schedules, schedule of values, product data and samples, proposed product lists, executed change orders, and verified reports;

(k) Failure of the Contractor to maintain and submit record as-built drawings;

(l) Erroneous estimates by the Contractor of the value of the Work performed, or other false statements in an Application for Payment;

(m) Unauthorized deviations from the Contract Documents;

(n) Failure of the Contractor to prosecute the Work in a timely manner in compliance with established progress schedules and completion dates;

(o) Subsequently discovered evidence or observations nullifying the whole or part of a previously issued Change Order or Certificate for Payment;

(p) Previous overpayment to Contractor;

(q) Credits owed to the City for reduced scope of work or work that the City otherwise permits Contractor to not perform, and such credits will be based on the reasonable bid value of the unperformed work, including markups for overhead and profit;

(r) The estimated value of performing work deleted pursuant to Section 8-12, "Use of Completed Portions; City's Right to Complete;"

(s) False claims by Contractor;

(t) Breach of any provision of the Contract Documents;

(u) Potential loss, liability or damages to the City that is potentially caused by the Contractor; and

(v) As permitted by other provisions in the Contract.

The City shall provide written notice to Contractor of items for which the City is withholding from a payment at the time that the payment is being processed. To claim wrongful withholding by the City, or if Contractor otherwise disputes any amount being withheld, Contractor must follow the claim procedures of Section 4-12, "Notices, Change Orders, and Claims." Upon request of the Contractor from whose payment or release the City withheld funds, the Contractor shall be given a written copy of the City's reasons for withholding. When the grounds for withholding funds are removed, payment or release shall be made for amounts withheld because of them. No interest shall be paid on any amounts withheld due to the failure of the Contractor to perform in accordance with the terms and conditions of the Contract Documents.

In addition to withholding amounts permitted by the Contract and statutes (including but not limited to Public Contract Code section 7107), the City may withhold an additional 50% contingency from any progress payment or retention release for any unknown, uncertain or estimated withhold amount. Once the withhold amount becomes known and certain, then the City shall continue to withhold the known and certain amount and credit, pay or release the remainder, if any, to Contractor. If the known and certain amount exceeds the amount previously withheld, then the City may withhold more from Contractor to cover the excess amount, if unpaid contract funds or retention funds are available for withholding.

The City's withholdings of any unpaid or unreleased amounts for costs, damages and claims against the Contractor shall take priority over any third party claims against the unpaid or unreleased amounts, including stop notices.

Any overpayment to the Contractor by the City, and any failure to withhold an amount from payment that the City had the right to withhold, shall not constitute a waiver by the City of its rights to withhold for such amounts from future payments to the Contractor or to otherwise pursue those amounts from the Contractor.

For any stop notice enforcement action against the City filed by any of the Contractor's subcontractors or suppliers of any tier, the Contractor shall defend and indemnify the City, and its officers, agents and employees, against any and all liability, loss, and damages.

9-8 Payment Of Withheld Funds (Substitutions for 5% retention)

Reference is made to the retention provisions of Section 9-6, "Partial (Progress) Payments and Retentions." Upon the Contractor's request, pursuant to Public Contract Code Section 22300, the City

will make payment of funds withheld from progress payments to ensure performance of the contract if the Contractor deposits in escrow with the City or with a bank acceptable to the City, securities equivalent to the amount withheld. The Contractor shall be beneficial owner of any securities substituted for moneys withheld and shall receive any interest thereon. Upon satisfactory completion of the Contract, the securities shall be returned to the Contractor.

Alternatively, upon the Contractor's request, the City will make payment of retentions earned directly to an escrow agent. The Contractor may direct the investment of the payments into securities, and the Contractor shall receive the interest earned on the investments upon the same terms provided for securities deposited by the Contractor. Upon satisfactory completion of the contract, the Contractor shall receive from the escrow agent all securities, interest and payments received by the escrow agent from the City, pursuant to the terms in Section 22300 of the Public Contract Code.

Securities eligible for investment shall include those listed in Section 16430 of the Government Code, bank or savings and loan certificates of deposit, interest-bearing demand deposit accounts, standby letters of credit or any other security mutually agreed to by the Contractor and the City.

The escrow agreement used pursuant to this Section 9-8 shall be substantially similar to the "Escrow Agreement for Security Deposits In Lieu of Retention" in Section 22300 of the Public Contract Code, deemed as incorporated herein by reference. The Contractor shall obtain the written consent of the surety to the agreement.

Any of the alternatives to the retentions normally withheld by the City are subject to the provisions of Section 9-7, “Stop Notices; City’s Right To Withhold Payments,” and to the approval of the City Finance Director.

9-9 Notice Of Potential Claim

In the event that a dispute over the conduct or payment of any portion of the Work was not resolved by issuance of a contract change order or other agreement between the Contractor and the Engineer, and it is the intent of the Contractor to submit a formal claim to resolve the matter, the Contractor shall file with the Engineer a written notice of such intent pursuant to Section 4-12, “Notices, Change Orders, and Claims.” Such notice of potential claim shall be filed at the earliest possible time to permit early resolution, if possible, but in any case, within 5 calendar days of the time the dispute first arose. The notice shall provide the nature and circumstances involved in the dispute, which shall remain consistent throughout the dispute.

9-10 Final Progress Payment

Provided no notices of potential claim, proposed change orders, or claims are pending under Section 4-12, “Notices, Change Orders, and Claims,” the Engineer shall, after the completion of the Contract, make a final estimate of the amount of work done thereunder and the value of such work; and the City shall pay the entire sum so found to be due after deducting therefrom five (5) percent of the final estimate, or other amounts as provided in Section 9-6, “Partial (Progress) Payments and Retentions” and Section 9-7, “Stop Notices; City’s Right To Withhold Payments,” to be retained following completion of the work.

If a notice of potential claim, proposed change order, or claim is pending under Section 4-12, “Notices, Change Orders, and Claims,” and is not resolved in time necessary for the processing of the final monthly progress payment as provided in the above paragraph, the Engineer shall cause a semi-final estimate to be prepared, and the Contractor shall be paid any amounts due less any retentions as provided in Section 9-6, “Partial (`Progress’) Payments and Retentions, ” and Section 9-7, “Stop

Notices; City's Right to Withhold Payments." Upon resolution of the procedures under said Section 4-12, a final estimate will be prepared as above provided, and a final progress payment shall be made.

9-11 Final Payment To Release Owner

The acceptance, without notice of potential claim, by the Contractor of the final payment shall be and shall operate as a release to the Owner (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 the Contractor's claims, if any, for amounts withheld by the City, upon final payment. However, no payment, final or otherwise, shall operate to release the Contractor or his sureties from any obligation upon or under this Contract or the Contractor's bond.

9-12 Payment Of Retention

Retention shall be released at the latest sixty (60) days after the occurrence of any of the definitions of "Completion" for purposes of Public Contract Code Section 7107 (see definitions of "Completion" in Section 1-8B). Any final payment and release of retentions will exclude any amounts withheld in conformance with Section 9-7, "Stop Notices; Rights of the City to Withhold Payments," and Public Contract Code section 7107. When specified in the Contract Specifications, certain portions of the amount retained pursuant to Section 9-6, "Partial ('Progress') Payments and Retentions," may be withheld until the satisfactory completion of a ninety (90) day maintenance period required for work pertaining to the installation of landscaping and irrigation facilities in accordance with Sections 20-8, "Maintenance Period," and 21-12, "Maintenance Period."

SECTION 10 - DUST CONTROL

10-1 Dust Control

This work shall consist of maintaining 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. The requirements of Section 7, "Legal Relations and Responsibilities," as it relates to air pollution, water pollution, public convenience, and public safety shall be adhered to as a part of providing Dust Control.

The Contractor shall make arrangements for and shall acquire and pay all costs for a satisfactory water supply in accordance with Section 5-13, "Electrical and Water Service," and Section 17, "Water Use." The Contractor shall furnish equipment for transporting and applying water for dust control. The equipment shall meet the approval of the Engineer. Water for the work may be taken from a City approved source. If taken from the City water system, the contractor shall obtain a water meter from the Utilities Section of the City Public Utilities Department Operations Center at 155 N. Sunnyside Avenue, and make payment of any deposit required therefor. The Contractor will be charged for water consumed. Where the Contractor is allowed to utilize the City water supply, if the City furnished meter is not so equipped, the Contractor shall provide an approved backflow prevention device between the public water supply and his equipment for applying or transporting water when the Engineer determines that a backflow condition could be caused by the method or equipment used to draw water from the public supply. In addition to fees and charges related to use of the water meter and the water consumed, the Contractor will be charged penalties for failure to return the meter for periodic reading as required by the Department, and/or failure to timely return the meter after completion of the project.

The Contractor shall comply with all the requirements of Section 7-6, "Air Pollution Control." The Contractor shall submit a Dust Control Plan to the Engineer when such plan is required by the regulations of the San Joaquin Valley Air Pollution Control District or the Contract Specifications.

If the Contractor fails to provide dust control measures so ordered by the Engineer within one hour after being notified, the Contractor shall pay to the City a penalty of fifty dollars ($50.00) for each half 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 mitigated. Such penalty shall be deducted from any monies owed the Contractor or invoiced to the contractor. In addition to the penalties as specified above, if conditions warrant, the Engineer may order City forces to eliminate or prevent the dust nuisance. An amount equal to three (3) times the City's actual cost thereof, in addition to the penalties as herein provided, shall be deducted from any monies owed the Contractor or shall be invoiced to the Contractor. Reference is made to Section 9-7, "Stop Notices; City's Right to Withhold Payments."

10-2 Payment

Payment for Dust Control shall include the cost for all labor, materials, and equipment, including the cost of all water used in the performance of the work, necessary to provide dust control and to comply with all regulatory agencies' requirements. Where the Contract includes a lump sum bid item for Dust Control, full compensation for dust control shall be included in the lump sum price bid therefor. Payment will be prorated on the basis of the ratio of the total Contract amount ($) completed to date to the total original Contract amount less the sum of dust control and any other prorated items.

Where no bid item is provided for dust control, the cost thereof shall be included in the various bid items of work; no separate payment will be made therefor.

SECTION 11 - MOBILIZATION

11-1 Description

Mobilization shall consist of preparatory work and operations, including those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site.

Mobilization shall conform to the requirements of Section 11, "Mobilization," of the State Standard Specifications. The following references therein shall have the meanings given below:

Section 7-1.17, "Acceptance of Contract," shall mean Section 8-14, "Acceptance of Contract," of these Standard Specifications.

Section 9-1.06, "Partial Payments," shall mean Section 9-6, "Partial ("Progress") Payments and Retentions," of these Standard Specifications

Section 9-1.07, "Payment after Acceptance" shall mean Section 9-12, "Payment of Retention," of these Standard Specifications.

SECTION 12 - TRAFFIC CONTROL; CONSTRUCTION TRAFFIC CONTROL DEVICES

12-1 General

This work shall consist of providing for the convenience and safety of traffic in connection with the Contractor's operations. Traffic control shall be furnished, provided and maintained in accordance with Section 12-2.01, "Traffic Control Plan; Notifications," by the Contractor at all times throughout the life of the Contract. All traffic control devices used in the performance of traffic control shall conform to the requirements of Section 12-3, "Construction Area Traffic Control Devices. The Contractor shall comply with the provisions of Section 7-17, "Public Convenience," and Section 7-18, "Public Safety."

12-2 Traffic Control

12-2.01 Traffic Control Plan; Notifications

A. Traffic Control Plan. Unless otherwise specified in Contract Specifications, a Traffic Control Plan shall be prepared by the Contractor for all Contracts, and submitted to the Engineer for approval prior to beginning construction. Construction shall not begin without an approved plan. The Traffic Control Plan shall conform to the requirements of this Section 12, "Traffic Control; Construction Area Traffic Control Devices," and Part 6 of the California MUTCD. Where road closures are anticipated or required, the Contractor shall comply with Section 4-14, "Detours," and Section 12-2.04, "Road Closures," for special plan preparation requirements.

B. Notifications. At least forty eight (48) hours in advance of beginning work in any street, alley, or other public thoroughfare, the Contractor shall notify the Engineer, the City Police and Fire Departments, all ambulance companies, and any other jurisdictional agencies involved and comply with their requirements regarding traffic control and public convenience and safety.

   In addition, the Contractor shall keep the City Fire Department, Police Department and ambulance companies informed at all times as to the exact location and progress of the work and shall notify them immediately of any streets closed to traffic or impassable for fire fighting or other safety equipment.

   In accordance with Section 8-7, "Notice to Residents," residents along the work area shall be provided passage as far as practicable, as determined by the Engineer. Convenient access to driveways, houses and businesses along the road, street, alley or other work area shall be maintained; temporary trench crossings shall be provided and maintained in good condition as required to provide said access. All costs for providing all noticing specified herein shall be included in the cost of providing traffic control

12-2.02 Contractor's Operations

The Contractor shall so conduct his operations as to cause the least possible obstruction and inconvenience to public traffic and abutting property owners (or tenants), and he shall have under construction no greater length or amount of work than he can prosecute properly with due regard to the rights and safety of the public. Unless otherwise provided by the Contract Specifications or approved by the Engineer, all traffic shall be permitted to pass through the work.

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 throughout the duration of the contract that the road, street, or other work area is under construction and of any

dangerous condition to be encountered as a result thereof. Traffic control conforming to Part 6 of the California MUTCD shall be maintained at all times in, through, and surrounding the construction site. Compliance with the requirements of said manual shall be considered as a minimum requirement and the Contractor shall provide additional safety devices when necessary to maintain a safe condition. The Contractor may be required to cover certain signs which regulate or direct public traffic to roadways that are not open to traffic. The Engineer will determine which signs shall be covered.

Safe, adequate, continuous and unobstructed pedestrian and vehicular access shall be maintained to fire hydrants, residences, commercial and industrial establishments, etc., unless other arrangements satisfactory to the owners have been made. Safe and adequate pedestrian zones and public transportation stops, as well as pedestrian crossings of the work at intervals not exceeding 300 feet also shall be maintained unless otherwise approved by the Engineer.

Where public traffic and/or emergency vehicles must be routed over areas under construction, the contractors operations shall be conducted in such a manner as to provide a smooth and stable roadway surface at all times when the specific area is not under actual construction. Dust control conforming to Section 10, "Dust Control," shall be provided at all times. Alternating traffic over work areas, use of one-way traffic control with flaggers, or any other methods used by the Contractor shall be approved by the Engineer and shall conform to Part 6 of the California MUTCD.

12-2.03 Flaggers

Flaggers while on duty and assigned to traffic control or to give warning to the public that the street or other area is under construction and of any dangerous conditions to be encountered as a result thereof, shall perform their duties and shall be provided with the necessary equipment in conformance with Part 6 of the California MUTCD. The equipment shall be furnished and kept clean and in good repair by the Contractor at the Contractor's expense.

12-2.04 Road Closures

Where road closures and detours are required by the Contract Specifications or the plans, the Contractor shall implement such closures in accordance with the provisions thereof.
Notifications shall be provided in accordance with Section 12-2.01, "Traffic Control Plan; Notifications."

Where road closures are prohibited by the Contract Specifications and work must pass through or over areas of construction, the Contractor shall conduct his operations in accordance with Section 12-2.02, "Contractor's Operations."

Where road closures are not prohibited by the Contract Specifications, and the Contractor for his own convenience requests a closure, such request shall be made to the Engineer in writing not less than ten (10) working days prior to the requested date of closure. Such request shall be accompanied by a Traffic Management Plan (Road Closure and Detour Plan) prepared by a Civil or Traffic Engineer registered by State of California. The Plan shall conform to the appropriate Part(s) of the California MUTCD. The Engineer shall respond to the Contractor not less than four (4) working days prior to the requested date of closure. If approved by the Engineer, the Contractor shall implement the plan as prepared, including any amendments made by the Engineer thereto. Notifications shall be made in accordance with Subsection 12-2.01, "Traffic Control Plan; Notifications."

Where the Engineer determines that non-emergency traffic or other conditions warrant closure of a road, the Engineer may direct the Contractor to immediately prepare a Traffic Management Plan no later than twenty four (24) hours for review by the Engineer. Alternatively, the City may prepare such Plan. The Contractor shall implement the Plan at the time prescribed by the Engineer.

Changed conditions considered to be dangerous or emergencies requiring immediate closure of a road shall immediately be brought to the Engineer's attention. If deemed warranted by the Engineer, the Contractor shall immediately implement the closure in accordance with the instructions given by the Engineer.

12-2.05 Deficiencies

Should the Contractor appear to be neglectful or negligent in furnishing warning devices and taking protective measures as provided in Section 12-2.02, "Contractor's Operations," the Engineer may direct the Contractor's attention to the existence of a hazard and the necessary warning devices shall be furnished and installed and protective measures taken by the Contractor at the Contractor's expense. Should the Engineer point out the inadequacy of warning devices and protective measures, that action on the part of the Engineer shall not relieve the Contractor from responsibility for public safety or abrogate the obligation to furnish and pay for these devices and measures.

Reference is made to Section 7-18, "Public Safety," and the penalties described therein for failure to correct hazards identified by the Engineer. In addition to penalties to correct hazardous conditions, the Contractor shall pay a penalty of $250.00 per day for each day in which work is begun prior to implementing traffic control in conformance with this Section 12. In conformance with Section 9-7, "Stop Notices; Right to Withhold Payments," said costs and penalties shall be deducted from any monies owed the Contractor or shall be invoiced to the Contractor.

12-3 Construction Area Traffic Control Devices

12-3.01 Traffic Control Devices

All traffic control devices required in these specifications and furnished by the Contractor shall conform to the requirements of Section 12-3, "Traffic-Handling Equipment and Devices," of the State Standard Specifications. All references therein to the MUTCD and MUTCD California Supplement shall mean the California MUTCD as defined in Section 1, "Definitions and Terms."

12-4 Measurement And Payment

Unless otherwise provided in the Contract Specifications, all costs for providing Traffic Control and Construction Area Traffic Control Devices as required in this Section 12 shall be measured and paid for at the lump sum price bid for Traffic Control, and includes compensation for furnishing all labor, materials, tools, equipment, signs, devices, pavement markings, channelizers, flaggers as required, road closures and detours as shown on the Plans or specified in the Contract Specifications, temporary fences, securing approval of traffic control plans, notifications, providing convenient access to adjacent residences and businesses, all devices required for the control of traffic as herein provided, and all incidentals and work required for furnishing Traffic Control and Construction Area Traffic Control Devices.

At the discretion of the Engineer, monthly progress payments may be prorated on the basis of the ratio that the completed dollar amount of the work bears to the total contract dollar amount, less any other prorated items.

Where no bid item for Traffic Control is provided, all costs for providing Traffic Control and Construction Area Traffic Control Devices shall be included in the various bid items of work; no additional payment will be made therefor.

Where road closures and detours are provided for the convenience of the Contractor which are not otherwise shown on the Plans to be constructed, all costs shall be borne by the Contractor for such

road closures and detours, including preparation of the required Traffic Management Plan. No additional payment will be made therefor.

Where the Engineer determines that non-emergency, emergency, or hazardous conditions not created by the Contractor, nor are due to the failure of the Contractor to act or use due diligence and care in performance of the work, warrants road closures and detours which are not otherwise shown on the Plans to be constructed, the cost thereof shall be paid for as extra work in accordance with Section 9-5, "Payment for Extra Work," including preparation of a Traffic Management Plan if so directed by the Engineer.

Where road closures and detours are made necessary due to conditions created by the Contractor, or due to the failure of the Contractor to act or use due diligence and care in the performance of the work, and where no closure or detour was otherwise contemplated, the Contractor shall be responsible for the cost thereof including the cost of preparing a Traffic Management Plan. No additional payment will be made therefor.

SECTION 13 (BLANK)

SECTION 14 (BLANK)

SECTION 15 - REMOVING EXISTING FACILITIES

15-1 General

15-1.01 Description
This work shall consist of removing existing facilities which interfere with construction within the area to be cleared and grubbed as specified in Section 16, "Clearing and Grubbing," or within any area of construction or reconstruction shown in the Plans or specified in the Specifications, or as directed by the Engineer. Removed facilities shall be disposed of, salvaged, relaid, reset, relocated or reconstructed as shown on the Plans or specified in the Contract Specifications.

Trenches, holes, depressions and pits caused by the removal of existing facilities shall be backfilled with embankment material as provided in Section 19, "Earthwork." Trenches, holes, depressions and pits caused by the removal of street or other facilities that are in surfaced areas, otherwise to remain undisturbed, shall be backfilled with materials equal to or better in quality and to the same thicknesses as the surrounding materials.

15-1.02 Preservation Of Property
Existing facilities which are to remain in place shall be protected in conformance with the provisions of Sections 5-3, “Contractor’s Responsibility for Work,” 5-9, “Preservation of Property,” 7-4, “Contractor’s Insurance Requirements and Hold Harmless,” Section 7-16, Injury or Damage to Persons or property,” and Section 8-15, "Utility and Non-Street Facilities; Potholing."

15-1.02(A) Traffic Signal Detection Loops
Traffic Signal Detection Loops may exist as far as 300 feet or more from a signalized intersection. After calling for USA mark-outs, the Contractors working within such an area must meet with the City Traffic Signal Technician at the project site to physically review all detection loops in the area in order to minimize damage to the existing loops that are to remain. Any loops that are to remain which are damaged by the Contractor’s operation shall, at the Contractor’s expense, be replaced in accordance with the provisions in Section 86, “Traffic Signals and Intersection Safety Lighting,” and as directed by the Engineer.

15-2 Miscellaneous Facilities

15-2.01 Description
Miscellaneous facilities shall include all structures, drainage, irrigation, water and sewer facilities, water wells or cisterns, drain wells, septic tanks or pits, leach fields, right of way and traffic control facilities including traffic signal detection loops, mail boxes, fences, walls, survey monuments, corners, or other markers, private driveways or approaches, and any other miscellaneous improvements or facilities not mentioned in this Section 15-2 but located within the area to be cleared and grubbed, constructed, or reconstructed, except concrete, bridges and concrete culverts which are provided for in Sections 15-3, “Removing Concrete,” and 15-4, "Bridge, Concrete Culvert Removal."

15-2.02 Removal Methods
Removing or abandoning existing facilities which interfere with construction or which are directed to be removed or abandoned by the Engineer shall be performed as shown on the Plans, as specified in the Specifications, or as directed by the Engineer.

15-2.02(A) Well Abandonment
All existing drainage or supply wells, within the limits of the project, which are not in use or intended for future use shall be abandoned in accordance with State of California Bulletin 74-81, Water Well

Standards, as amended by Bulletin 74-90, Fresno County Health Department regulations, and the Clovis Standard Drawing therefor. The Contractor performing the well abandonment shall be licensed to perform such work (~~Class A or~~ Class C-57) in accordance with the provisions of the State Business and Professions Code, Chapter 9, Division 3.

The Contractor shall obtain a permit for the work from the Clovis Building Division prior to performing the well abandonment, and shall coordinate with the Building Division for inspection of the work as required. The exposed well shall be securely covered during all periods of inactivity with a suitable cover sufficiently anchored to prevent hazard to the public and/or contamination of the well.

15-2.02(B) Obliterating Roads And Detours

Unless otherwise specified in the special provisions, obliteration shall consist of placing an earth cover of not less than 0.5-foot in thickness or shall consist of rooting, plowing, pulverizing, or scarifying to a minimum depth of 0.5-foot or to the bottom of the impermeable underlying base, whichever is the greater.

When obliteration is accomplished by rooting, plowing, pulverizing, or scarifying, the bituminous material shall be broken up into pieces not larger than 4 inches in greatest dimension and mixed with an equal amount of underlying material. After obliteration, the area shall be graded, as directed by the Engineer, so that it will blend in with the surrounding terrain and be well-drained.

If the Contractor elects to obliterate surfacing by placing an earth cover, the existing base and surfacing shall be scarified for its full depth and broken up so that the material contains no lumps larger than 12 inches in greatest dimension before the earth cover is placed.

Wherever a portion of existing surfacing is to be obliterated, the outside edge of the existing surfacing, which is to remain in place, shall be sawed to a neat line, prior to obliteration operations.

15-2.02(C) Traffic Stripes And Pavement Markings

1. Where shown on the Plans or specified in the Contract Specifications, traffic stripes and pavement markings (paint and thermoplastic) to be removed shall be accomplished by wet sandblasting or other approved methods which will cause the least possible damage to the pavement. Dry sandblasting may be used in selected areas only with the permission of the Engineer and with approval of the air pollution control authority having jurisdiction over the area in which the work will be performed. Alternate methods of removal require prior approval of the Engineer.

   Pavement marking images shall be removed in such a manner that the old message cannot be identified. Where grinding is approved by the Engineer for use, the pavement marking image shall be removed by grinding a rectangular area. The minimum dimensions of the rectangle shall be the height and width of the pavement marking. Residue resulting from removal operations shall be removed from pavement surfaces by sweeping or vacuuming before the residue is blown by the action of traffic or wind, migrates across lanes or shoulders, or enters into drainage facilities. Traffic stripes shall be removed before any change is made in the traffic pattern.

   Traffic Stripes and Pavement Markings designated to be removed and not to receive a pavement surface treatment per Section 15-2.02(C)2 shall be removed completely as herein specified and the surface sealed with a “Walkmaster” or an equivalent slurry approved by the

Engineer. Any voids created by grinding shall be filled using a Type II slurry approved by the Engineer.

All existing striping, stenciling, or other markings, whether shown for removal or not, that will be in conflict with the intent of any new striping shown on the Plans or specified in the Contract Specifications, shall be removed. Where Traffic Striping or Pavement Markings are to be removed and not to be followed by any of the applications described below, the pavement shall be sealed as specified in the Contract Specifications. If not specified, the Contractor shall seal the pavement using a method to be approved by the Engineer.

2. Traffic stripes and Pavement Markings to be removed for various pavement surface treatment operations shall comply with the following:

   Preparation for Fog Seal or Slurry Seal.
   In addition to the provisions of (1) above, for Fog Seal and Slurry Seal applications, the Contractor shall protect existing permanent raised pavement markers from damage or coating. Damaged or coated markers shall be replaced in accordance with Section 85, "Raised Pavement Markers," at the contractor's expense.

   Preparation for Cape Seal.
   In addition to the provisions of (1) above, for Cape Seal applications the Contractor shall remove permanent raised pavement markers in conformance with Section 15-2.02(D) "Pavement Markers," and at the completion of work replace them in accordance with Section 85, "Raised Pavement Markers."

   Preparation for Overlay.
   Unless the Plans or Contract Specifications require otherwise, for Overlay applications, the Contractor shall only remove permanent raised pavement markers in conformance with Section 15-2.02(D) "Pavement Markers," and at the completion of work replace them in accordance with Section 85, "Raised Pavement Markers."

3. The Contractor shall remove the existing paint and thermoplastic stripping, pavement markings or raised pavement markers where required, no earlier than five (5) days before the start of any of the applications specified in (2) above. After removing the existing paint, markings, or markers, unless otherwise authorized by the Engineer, the Contractor shall immediately install temporary reflectorized markers which shall be left in place until beginning the applicable application.

   Extra caution shall be required at locations with traffic signal loops where pavement markings or striping must be removed. Loops are located just below surface grade. Temporary reflective road marker tabs, manufactured by Hye Lites, Davidson Plastic Co. MV Plastic Chip Seal Marker or approved equal, shall be placed in accordance with the manufacturer's specifications but not more then 15-foot intervals. Temporary reflective road marker tabs shall also be placed at all stop bars that are removed and shall have a minimum of six (6) reflectors or as directed by the Engineer.

   All temporary markers shall be completely removed prior to the applicable applications specified in (2) above and reinstalled upon completion of the application prior to installation of permanent striping. All protective covers of markers left in place shall be removed after the application for nighttime reflectivity and visibility. Prior to the application of paint, thermoplastic stripping, and pavement markings, temporary road marker tabs shall be

removed completely. Re-installation of Traffic Stripes and Pavement Markings shall comply with Section 84, “Traffic Stripes, Signs, and Pavement Markings.”

15-2.02(D) Pavement Markers

Where removal of existing raised pavement markers is called for on the Plans and/or Contract Specifications, markers including underlying adhesive shall be removed by an approved method that will result in the least possible damage to the pavement or other surfacing. Damage to the pavement or surfacing caused by pavement marker removal shall be repaired by the Contractor at the Contractor's expense by methods acceptable to the Engineer. Pavement markers, whether shown for removal or not, that will be in conflict with the intent of any new striping diagram, shall be removed. During the removal of ceramic type pavement markers, screens or other protective devices shall be furnished to contain any fragments as provided for in Section 7-18, "Public Safety." Fragments resulting from the removal of pavement markers shall be removed from the roadway before the lane or lanes are opened to traffic.

Removal shall be at the direction of the Engineer. The cost thereof shall be included in the various items of work; no additional compensation will be paid therefor.

15-2.02(E) Traffic Signs

All traffic signs and street signs within the limits of the improvement, if required, shall be removed, salvaged and stockpiled at locations designated by the Engineer. The Contractor shall install (and ultimately remove) temporary traffic control devices, if required, at locations designated by the Engineer. Traffic control signs and street signs previously removed and salvaged shall be replaced upon completion of the work.

15-2.03 Disposal

Removed existing facilities that are not to be salvaged or reused in the work shall become the property of the Contractor and shall be disposed of as provided in Section 5-12, "Disposal of Material Outside the Right of Way."

15-2.04 Salvage

Materials from existing facilities which are shown on the Plans or specified in the Contract Specifications to be salvaged, shall remain the property of the City. Salvaging shall include the removal, disassembly, preparation, marking, bundling, packaging, tagging, hauling and stockpiling of salvaged materials or facilities to the location specified in the Contract Specifications. Materials include parts, articles and equipment of assembled facilities. Salvaging does not include the preparation of existing material that is to be reused in the work.

Materials from an existing facility to be salvaged shall be salvaged; except, when only specific materials from the facility are designated to be salvaged, the remaining materials from that facility shall be removed and disposed of.

Materials to be salvaged shall not be removed until their use is no longer required as determined by the Engineer. Salvaged materials shall be cleaned of earth and other foreign materials. Adhering concrete shall be removed from salvaged materials.

When practicable, salvaged materials shall be hauled directly to the location specified in the Contract Specifications and stockpiled; however, salvaged materials may be temporarily stored at a location selected by the Contractor and approved by the Engineer, and later hauled to and stockpiled at the final location. Materials which are lost for any reason before stockpiling at the final location shall be either replaced by the Contractor at the Contractor's expense, or, at the discretion of the Engineer, the

estimated cost of replacement may be deducted from any moneys due or to become due to the Contractor.

Materials designated to be salvaged that are damaged, as determined by the Engineer, shall be segregated from undamaged material. The damaged material shall become the property of the Contractor and shall be disposed of outside the right of way in conformance with the provisions in Section 5-12, "Disposal of Material Outside the Right of Way."

Materials to be salvaged that are damaged as a result of the Contractor's operations shall be repaired by the Contractor, at the Contractor's expense, to the satisfaction of the Engineer. Materials that are damaged beyond repair as a result of the Contractor's operations shall be disposed of outside the highway right of way as provided in said Section 5-12 and replaced at the Contractor's expense, or, at the discretion of the Engineer, the estimated cost of replacement may be deducted from any moneys due or to become due to the Contractor. Replacements for lost or damaged materials shall be of the same kind and of the same or better quality and condition as the lost or damaged materials were prior to removal.

Salvaged material shall be packaged and bundled as specified in the Contract Specifications or as directed by the Engineer, except that frames and covers or frames and grates of existing manholes, inlets, or other facilities such as water valve frames and lids, shall be match-marked in pairs.

15-2.05 Reconstruction

Existing facilities that are shown on the Plans or specified in the Contract Specifications to be reconstructed or re-installed at existing or new locations shall conform to the design of the existing facilities and shall be equal in all respects to the best portions of the existing facilities. The work of reconstruction shall be performed in accordance with the Plans, Contract Specifications, and the requirements of these Specifications for new work of similar character, which apply to the type of facility to be reconstructed, adjusted, modified, remodeled, re-laid, relocated or reset. Where an existing facility not conforming to current Americans With Disabilities Act (ADA) Standards is to be replaced, unless otherwise shown on the Plans or specified in the Contract Specifications, the new facility shall be constructed to meet current ADA standards as directed by the Engineer.

Materials to be reused shall not be removed until their use is no longer required as determined by the Engineer. Materials to be reused in the work shall be cleaned of earth and other foreign materials. Adhering concrete shall be removed from materials to be reused in the work. Materials shown on the Plans or specified in the Contract Specifications to be reused in the work that are damaged as a result of the Contractor's operations shall be repaired by the Contractor, at the Contractor's expense, to the satisfaction of the Engineer. Materials that are damaged beyond repair as a result of the Contractor's operations shall be disposed of outside the right of way in conformance with the provisions in Section 5-12, "Disposal of Material Outside the Right of Way."

Material from existing facilities to be reused in the work that, in the opinion of the Engineer, is unsuitable for use in the work shall become the property of the Contractor and shall be disposed of in conformance with the provisions in said Section 5-12. The unsuitable material shall be replaced with material of a kind and quality equal to the best material in the existing facility. Furnishing of material to replace unsuitable materials as ordered by the Engineer will be paid for as extra work as provided in Section 4-11, "Extra Work."

15-2.05(A) Frames, Covers, Grates, And Manholes

Frames, covers or grates of existing manholes, water valve covers, inlets or other facilities shall be adjusted to grade with new materials in accordance with the provisions of these specifications, the Contract Specifications, and the Standard Drawings. In the absence of any requirements set forth by the foregoing, raising existing facilities to grade shall be accomplished using new materials similar in character to those in the original structure. Existing facilities being adjusted to grade shall be cleaned internally of all mud and debris down to and including the bottom of the manhole, other structure, or water valve box, regardless of whether the material was present prior to beginning of construction.

After the existing cover or grate frame has been removed, the top of the structure to be raised shall be trimmed to provide a suitable foundation for the new material. When reconstruction or adjustment of a concrete drainage or other facility requires partial removal of concrete, sufficient concrete shall be removed to permit new reinforcing steel to be spliced to existing reinforcing steel as specified in Section 52-1.08, "Splicing," of the State Standard Specifications. Existing reinforcement that is to be incorporated in new work shall be protected from damage and shall be thoroughly cleaned of adhering material before being embedded in new concrete.

Concrete removal shall be performed without damage to the portion that is to remain in place. Damage to the existing concrete, which is to remain in place, shall be repaired to a condition equal to that existing prior to the beginning of removal operations. The cost of repairing existing concrete damaged by the Contractor's operations shall be at the Contractor's expense.

If a manhole cover that is raised to grade is unstable or noisy under traffic, the conditions shall be corrected by placing a coil of asphalt saturated rope, a plastic-type washer or asphaltic compounds approved by the Engineer, on the cover seat.

Facilities located in the pavement area shall not be constructed to final grade until the adjacent pavement or surfacing has been completed. All facilities shall be raised to final grade within 10 calendar days of being covered with final paving. The Engineer shall approve the order in which facilities are raised.

Portions of manholes that are to be lowered shall be removed as directed by the Engineer. Where insufficient depth will exist to allow the proper use of grade adjusting rings to raise the cover to final pavement grade, the manhole shall be lowered to an approximate depth of 3.5 feet below finished grade and shall then be reconstructed with the proper taper to finished grade. When existing manholes or inlets are to be abandoned, pipes entering the manhole or inlet shall be securely closed by a tight fitting plug or wall of minor concrete not less than 0.5-foot thick, or by a tight brick wall not less than 0.67-foot thick with cement mortar joints. Minor concrete shall conform to the provisions in Section 90-10, "Minor Concrete," of the State Standard Specifications. The bases of manholes or inlets shall be broken in a manner to prevent entrapment of water. Unless otherwise specified by the Contract Specifications, the manhole or inlet shall be demolished to an elevation 3.5 feet below finished grade and backfilled in conformance with the provisions in Section 19-3.03(B), "Structure Backfill."

15-2.05(B) Fences

Corner posts with braces shall be placed at the junctions of reconstructed fences and existing cross fences and the two fences properly fastened thereto. Gates to be reused shall be installed in reconstructed fences at the locations designated by the Engineer. Clearing required for reconstructed fences shall conform to the provisions in Section 16, "Clearing and Grubbing." Removing and reconstructing fence shall be performed in a manner that will prevent the escape of any animals contained within the fenced area.

15-2.05(C) Extending Pipes
Existing pipe shall be extended as shown on the Plans or specified in the Contract Specifications and shall conform to the requirements for installing new pipe. Existing headwalls, endwalls, or other structures shall be removed and disposed of or moved to the extended location as shown on the Plans or directed by the Engineer. When headwalls or endwalls are to be moved, the pipe shall be cut with smooth edges at a point about one foot back of the headwall or endwall along a plane perpendicular to the center line of the pipe. The headwall or endwall shall then be moved and placed in its new location and the new pipe shall be connected to the existing pipe as shown on the plans or as directed by the Engineer.

15-2.06 Measurement
The work performed under this Section 15-2, "Miscellaneous Facilities," will be measured by units specified in the Contract Specifications for the various work described. In the absence of a contract item setting forth methods of measurement, the cost of the work involved shall be considered as included in the price paid for other various items of work, and no measurement is required.

15-2.07 Payment
When the contract includes separate items with unit or lump sum prices for removing, salvaging, adjusting, modifying, remodeling, abandoning, obliterating, relaying, reconstructing, relocating or resetting any of the miscellaneous facilities, the quantities will be paid for at the contract unit or lump sum price for the item of work involved. If no contract items are provided, then the cost thereof shall be considered to be included in the various other items of work. No additional payment will be made therefor.

Payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in completing the operations as shown on the Plans, as specified in the Specifications, and as directed by the Engineer.

Full compensation for all excavation and backfill required to remove, dispose of, salvage, relay, reset, relocate and reconstruct facilities for which payment is not otherwise provided, shall be considered as included in the contract unit or lump sum price paid for the item of work involved and no separate payment will be made therefor. If no contract items are provided, then the cost thereof shall be considered to be included in the various other items of work. No additional payment will be made therefor.

Full compensation for removal of existing striping, pavement markings, and raised pavement markers where required, including additional grinding outside the limits of the existing pavement marking image to obtain a rectangular area, and placement and removal of temporary pavement markings, and repainting or remarking, shall be considered as included in the contract price paid for the item of work involved and no additional compensation will be allowed therefor. If no contract items are provided, then the cost thereof shall be considered to be included in the various other items of work. No additional payment will be made therefor.

Full compensation for removing, preparing, disassembling, packaging, bundling, tagging, hauling and stockpiling of salvaged materials including any temporary storage prior to stockpiling and disposal of unwanted portions of facilities or damaged materials, shall be considered as included in the contract price paid for the item involved and no separate payment will be made therefor. In the absence of a contract item, the cost thereof shall be considered as included in the various other items of work. No additional payment will be made therefor.

When the contract does not include separate items for removing any of the existing facilities encountered within the area to be cleared and grubbed or the removal is not included in another item, then payment for removing the facilities shall be considered as included in the contract prices paid for clearing and grubbing or excavation of the type in which the facilities are located. If the contract does not include items for clearing and grubbing or excavation, then removing the existing facilities within the area to be cleared and grubbed will be considered as being included in the various items of work, and no additional payment will be made therefor.

When an existing facility which is outside the area to be cleared and grubbed is shown on the Plans or specified in the Contract Specifications to be removed and the contract does not include an item for its removal, or its removal is not included in another item, then payment for removing the facility will be considered as included in the contract price paid for clearing and grubbing. If the contract does not include an item for clearing and grubbing, then the cost thereof shall be considered as included in the various items of work and no additional payment will be made therefor.

If the Engineer orders the removal of a facility which is not shown on the Plans or specified in the Contract Specifications to be removed, then removing the existing facility will be paid for as extra work as provided in Section 4-11, "Extra Work."

15-3 Removing Concrete

15-3.01 Description

Concrete shall be removed at the locations shown on the Plans or described in the Contract Specifications, or where directed by the Engineer. Removal shall be to the lines and elevations shown, specified, or determined by the Engineer.

Concrete shall be defined as all or portions of mortared rubble masonry, brick or stone curbs, gutters and sidewalks; and portland cement concrete curbs, gutters, sidewalks, gutter depressions, driveways, aprons, slope paving, island paving, barriers, retaining walls, spillways, dams, structures, foundations, footings, and all other portland cement concrete or masonry construction, except bridges, concrete culverts and pavement which are provided for in Section 15-4, "Bridge, Concrete Culvert Removal," and Section 19-1.01, "Description."

Types of existing subbase, base, surfacing and pavement to be removed will be classified for payment as the type of excavation in which the subbase, base, surfacing and pavement are located. The work for removal of concrete shall include removal and disposal of any reinforcing steel except as provided herein.

Concrete pipe and clay pipe will be considered as miscellaneous facilities to be removed, salvaged, relaid or disposed of as provided in Section 15-2, "Miscellaneous Facilities," and will not be paid for as removing concrete.

15-3.02 Removal Methods

Unless otherwise specified in the Contract Specifications, existing concrete shall be removed to a depth of at least three feet below finished grade. Existing concrete shall be cut to a true line where new concrete is to join existing concrete. Explosives shall not be used for any concrete removal. Concrete removal operations shall be performed without damage to any portion that is to remain in place. Damage to the existing concrete, which is to remain in place, shall be repaired to a condition equal to that existing prior to the beginning of removal operations. The cost of repairing existing concrete damaged by the Contractor's operations shall be at the Contractor's expense.

Existing reinforcement that is to be incorporated in new work shall be protected from damage and shall be thoroughly cleaned of adhering material before being embedded in new concrete.

Unless otherwise provided in the Contract Specifications, removed concrete shall not be buried in adjacent embankments, and shall be disposed of in accordance with Section 5-12, "Disposal of Material Outside the Right of Way." If burial is otherwise provided for, removed concrete shall be broken into pieces which can be readily handled and incorporated into embankments and is placed at a depth of not less than 3 feet below finished grade and slope lines. The removed concrete shall not be buried in areas where piling is to be placed or within ten feet of trees, pipelines, poles, buildings or other permanent objects or structures.

The floors of concrete basements, pits and structures, that are not required to be removed and which are located within the roadway shall be broken in a manner that will prevent the entrapment of water. Full compensation for breaking up concrete will be considered as included in the prices paid for the various contract items of work and no separate payment will be made therefor.

When there is a contract item for shattering concrete, concrete pavement and similar slabs upon which embankments are to be constructed, the concrete shall be broken up into pieces not larger than 2 feet in greatest dimension and left in place.

15-3.03 Measurement

The work performed under this Section 15-3 and paid for by contract items will be measured by the method specified in the Contract Specifications. In the absence of a contract item for removing concrete, the cost thereof will be considered as being included in the various items of work and no measurement for payment will be made.

No deductions will be made from any excavation quantities for the volume of concrete removed.

15-3.04 Payment

Payment for concrete removal will be made at the price per unit of measurement specified in the Contract Specifications. Payment includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work and performing all the operations involved in removal of concrete as shown on the Plans, as specified the Specifications, and as directed by the Engineer. No additional compensation will be paid for the removal of concrete containing steel reinforcing or other steel where encountered.

In the absence of a contract item for removal of concrete, the cost thereof shall be considered as included in the various items of work, and no additional payment will be made therefor.

15-4 Bridge, Concrete Culvert Removal

15-4.01 Description

This work shall consist of removing existing bridges, concrete culverts, or portions thereof. The type and general dimensions of the bridges or portions of bridges or concrete culverts to be removed will be shown on the Plans or described in the Contract Specifications. For purposes of these Standard Specifications, "bridge" shall include concrete box culverts.

Where portions of bridges or culverts are to be removed, the removal operations shall be conducted so that there will be the least interference to public traffic using the structure involved. When complete bridges or culverts are to be removed, removal operations shall not be started until public traffic is no longer routed over the structure to be removed.

15-4.02 Removal Methods

At least 10 days before beginning bridge or culvert removal, the Contractor shall submit to the Engineer details of the removal operations showing the methods and sequence of removal and equipment to be used. Traffic control conforming to Section 12, "Traffic Control; Construction Area Traffic Control Devices," and as directed by the Engineer shall be provided.

Materials that are to be salvaged shall be carefully removed and stockpiled near the site at a location designated by the Engineer. Material which is to be used in any specified reconstructed bridge work and has been damaged or destroyed as a result of the Contractor's operations shall be repaired or replaced by the Contractor at the Contractor's expense.

Piling, piers, abutments and pedestals shall be removed to at least one foot below ground line or three feet below finished grade, whichever is lower.

Where portions of a bridge or culvert are to be removed, the removal operations shall be performed without damage to any portion of the structure that is to remain in place. In these cases, tools with a manufacturer's rated striking energy in excess of 1,200-foot pounds per blow, a freely falling mass or a falling mass attached to a cable, rope or chain shall not be used for breaking or removing concrete which is attached to or supported by the bridge. Existing reinforcement that is to be incorporated in new work shall be protected from damage and shall be thoroughly cleaned of all adhering material before being imbedded in new concrete.

A freely falling mass or a falling mass attached to a cable, rope or chain shall not be used above any area open to the public. Falling masses shall not be used within 30 feet horizontally of any area open to the public unless adequate protective shields are in place. Protective shields shall be of sufficient size and strength to prevent any debris or equipment from endangering the public. The shields shall be designed and proportioned as required by the size of equipment and method of operations employed, but in no case shall the shields have a strength less than that provided by good, sound 2-inch thick Douglas fir planking supported on posts at 5-foot centers.

Before beginning concrete removal operations involving the removal of a portion of a monolithic concrete element, a saw cut approximately one inch deep shall be made to a true line along the limits of removal on faces of the element which will be visible in the completed work.

15-4.03 Measurement And Payment

Unless otherwise provided in the Contract Specifications, the work to be performed in accordance with this Section 15-4 will be measured and paid for on a lump sum basis. Payment shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in removing bridges or concrete culverts or portions thereof, including salvaging materials not to be reused in the project when salvaging is specified and not otherwise paid for, as shown on the Plans, as specified in the Specifications, and as directed by the Engineer.

Full compensation for removing materials that are to be reused in the project shall be considered as included in the contract prices paid for reconstructing, relocating or resetting the items involved, or in such other contract pay items that may be designated in the Contract Specifications. No additional payment will be made therefor.

In the absence of a bid item for bridge or concrete culvert removal, the cost thereof shall be included in the various bid items of work, and no additional payment will be made therefor.

GRADING, LANDSCAPING, FINISHING ROADWAY

SECTION 16 - CLEARING AND GRUBBING

16-1 Description

Clearing and grubbing shall consist of the removal and disposal of all objectionable materials within the limits of the project as required by the Plans, these Specifications, the Contract Specifications, and as directed by the Engineer. Clearing and Grubbing shall be performed in advance of grading operations and in accordance with the requirements of these specifications. Reference is made to Section 15, "Removing Existing Facilities." Any existing facility not specifically designated on the plans or Contract Specifications to be removed or to remain shall be removed and disposed of in accordance with this Section 16. Removal and disposal of existing roadway or alley materials in advance of roadway or alley reconstruction shall be considered as excavation for the associated construction items and not a part of, or to be paid for as, Clearing and Grubbing. Any holes, depressions, or pits resulting from the removal of objectionable material shall be backfilled in accordance with Section 19-4, "Embankment Construction."

16-2 Preservation Of Property

The Contractor shall comply with the requirements of Sections 5-3, "Contractor's Responsibility for Work," 5-9, "Preservation of Property," 7-4, "Contractor's Insurance Requirements and Hold Harmless," 7-16, "Injury or Damage to Persons or Property," and Section 8-15, "Utility and Non-Street Facilities; Potholing." Whether shown on the Plans or not, existing improvements, adjacent property, utility and other facilities, and trees and plants that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations. Unless otherwise specified in the Contract Specifications or on the plans, only trees and plants that are designated on the plans or marked for removal by the Engineer shall be removed.

The Contractor shall notify Underground Service Alert and shall make such additional investigations and examinations as necessary to determine the existence and locations of all pipes, conduits, and other underground improvements and shall consult with and advise the owners of the utilities before undertaking any work that might endanger them.

The Contractor shall bear full responsibility for any damage to pipes, conduits, poles, or any other structures or utilities. The Contractor shall not make any claim for inconvenience, delay or added cost of performing the work which may be attributed in any degree to inaccuracy of information furnished by the City of Clovis relative to the locations, sizes, dimensions, depths, and character of any pipes, conduits, poles or other structures and utilities.

Existing survey monuments and stakes shall be fully protected from damage or displacement and they shall not be disturbed unless directed by the Engineer. Any survey monumentation disturbed in connection with the Contractor's operations shall be reset in accordance with Section 70-2, "Survey Monuments." Such re-monumentation shall be at the Contractor's expense with no additional compensation paid therefor.

16-3 Construction

Unless otherwise specified or shown on the Plans or specified in the Contract Specifications, the entire area within the project limits shall be cleared and grubbed by the Contractor. 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 on the Plans and included in the Specifications that is located in public streets, alleys, parks, trails, or other public rights of way of the City of Clovis shall be done in accordance with City ordinances regulating the use of public rights of way within the City, except as otherwise provided in these Specifications. The Contractor shall comply with all regulations and requirements of the City of Clovis and shall conduct his operations in compliance therewith.

Within the limits of Clearing and Grubbing, the area above the natural ground surface shall be cleared of all vegetation, such as trees, logs, upturned stumps, roots of down trees, brush, grass, weeds and other organic material, or other objectionable material as determined by the Engineer. The provisions of Section 20-1.03, "Rough Grading," apply for special treatment of grass, weeds, and other organic material in projects involving landscape planting.

Within the limits of Clearing and Grubbing, the area below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, large roots, buried logs, all other organic material and other objectionable material as determined by the Engineer, including but not limited to concrete or masonry, wood, metal, or other scrap. All recyclable items and materials to be removed shall be removed in a manner that facilitates their recycling.

Trees designated for removal shall be removed in such a manner as not to injure standing trees, plants, and improvements which are to be preserved. Tree branches extending over the roadway which interfere with the work shall be trimmed in a professional manner by the Contractor at the direction of the Engineer.

All concrete, asphalt-concrete and oiled dirt within the right-of-way shall be removed by the Contractor unless designated to remain on the Plans. If said concrete, asphalt-concrete, or oiled dirt is located within the roadway, alley, curb and gutter, or sidewalk prism to be replaced, the removal shall be considered as included in the contract items of work for the replacement and not as Clearing and Grubbing.

Where a portion of an existing concrete facility is to be removed, it shall be cut to a minimum depth of 1.5 inches with an abrasive type saw at the first scoring line at or outside the planned 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. The shortest allowable remaining portion between expansion joints shall be 7.5 lineal feet. No patching at expansion joints will be permitted. Removal of portions of asphalt concrete shall done as indicated in the Plans or Contract Specifications.

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

Existing manholes, drain wells, drainage structures, structures and headwalls to be abandoned shall be removed in accordance with Section 15, "Removing Existing Facilities." If no contract item is provided therefor, removal shall be considered as Clearing and Grubbing.

All traffic signs and street signs within the limits to be cleared and grubbed shall be considered as "Miscellaneous Facilities," and if required, shall be removed, salvaged and stockpiled in accordance with Section 15-2, "Miscellaneous Facilities," of said Section 15.

16-4 Removal And Disposal Of Materials
All materials removed and not otherwise specified to be salvaged or reused in the work shall be lawfully disposed of by the Contractor at disposal sites outside the right-of-way in conformance with. Section 5-12, **"**Disposal Of Material Outside The Right- Of-Way."

All existing materials that are designated to be salvaged shall be removed, cleaned and hauled to the location shown on the Plans or specified in the Contract Specifications and in accordance with Sections 6-11, "Salvage of Materials," and 15-2.04, "Salvage." The roadway and adjacent areas shall be left with a neat and finished appearance. No accumulation of flammable material shall remain on, or adjacent to, the right-of-way.

16-5 Measurement
Clearing and Grubbing will be measured on a lump sum basis.

16-6 Payment
The lump sum price paid 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 Plans, set forth in the Specifications, and as directed by the Engineer.

If the Contract does not include a pay item for Clearing and Grubbing as herein specified, and unless otherwise provided in the Contract Specifications, full compensation for clearing and grubbing required to perform the construction operations specified shall be considered as included in the price bid for other various items of work and no additional compensation will be paid therefor.

SECTION 17 - WATER USE

17-1 Description

This work shall consist of developing a water supply and furnishing all water required for the work, and applying all water. The Contractor shall comply with the provisions of Section 5-13, "Electric and Water Service."

Water for use in the work shall, at the option of the Contractor, be potable or non-potable, except for water used in connection with any phase or part of installing, repairing, cleaning, disinfecting, or pressure testing of sewers, sewer force mains, recycled water mains, and potable water systems. Water for such use shall be potable only. Sources of non-potable water supply shall be approved by the Engineer and such water shall be chemically and biologically suitable for the intended use.

Potable water may be furnished by the Contractor from an independent source, or may be obtained from the City Water System.

In compliance with Section 20, "Landscape Planting," and Section 21, "Landscape Irrigation Systems," the water supply for landscape planting and irrigation systems shall be provided by the Contractor in accordance with the Plans and Contract Specifications. A permanent water meter will be furnished by the City for each irrigation system connection to the City water system unless otherwise shown on the Plans or specified in the Contract Specifications. The Contractor will be charged for all water consumed through these connections, including water consumed through the temporary hydrant meter obtained in compliance with this Section 17, and water consumed for irrigation system testing purposes and for landscape irrigation through the 90-day maintenance period and up to final acceptance of the work by the Engineer. Water for construction purposes for landscape planting and installation of irrigation systems, such as for dust control, compaction, etc., shall be obtained in accordance with 5-13, "Electrical and Water Service," Section 17-1(A), "City Water Permit," and Section 17-1(B), "Nonpotable Water."

17-1(A) City Water Permit

Prior to taking any water from the City water system, the Contractor shall obtain a City of Clovis fire hydrant permit and water meter. Said permit and the required water meter are available at the Public Utilities Department Operations Center at 155 N. Sunnyside Avenue. All water taken from City hydrants must be metered and the Contractor shall pay all fees relating to the use of the water meter and water consumed, as outlined in Section 6.5.103(e) of the Clovis Municipal Code and this Section 17. Any unpaid balance will be deducted from amounts owed the Contractor. A backflow prevention device approved by the Engineer shall be provided and connected between the hydrant water meter and the equipment receiving the water, or the equipment must have an approved backflow prevention device installed thereon.

17-1(B) Nonpotable Water

Non-potable water consists of non-potable water developed from other sources of water such as that furnished by an irrigation district. The Contractor shall pay all costs and fees and comply with all regulations or permit requirements of the supplier. The Contractor shall furnish the Engineer with a copy of the permit or other written authorization of the supplier before the use of any such water will be permitted on the work.

Non-potable water used in the mixing and curing of concrete shall conform to the provisions in Section 90-2.03, "Water," of the State Standard Specifications. Non-potable water, if used, shall not be conveyed in tanks or drain pipes which will be used to convey potable water. There shall be no

connection between non-potable water supplies and potable water supplies. Non-potable water supply, tanks, pipes and any other conveyances of non-potable water shall be labeled:

NONPOTABLE WATER

DO NOT DRINK

17-2 Application

Water shall be applied in the amounts, at the locations, and for the purposes designated in the Contract Specifications and these Standard Specifications, and as ordered by the Engineer. Water for compacting embankment material, subbase, base and surfacing material, and for providing dust control shall be applied by means of pressure-type distributors or pipe lines equipped with a spray system or hoses with nozzles that will ensure a uniform application of water. Equipment used for the application of water shall be equipped with a positive means of shut-off.

Unless otherwise permitted by the Contract Specifications or the Engineer, or unless all the water is applied by means of pipe lines, at least one mobile unit with a minimum capacity of 1,000 gallons shall be available for applying water on the project at all times.

17-3 Chemical Additives

If the Contractor elects to do so, chemical additives may be used in water for compaction. If chemical additives are used, furnishing and applying the additives shall be at the Contractor's expense. The right is reserved by the Engineer to prohibit the use of a particular type of additive, to designate the locations where a particular type of additive may not be used, or to limit the amount of a particular type of additive to be used at certain locations, all if the Engineer has reasonable grounds for believing that such use will in any way be detrimental.

17-4 Payment

Full compensation for developing and furnishing water in compliance with this Section 17 shall be considered as included in the various contract items of work requiring water, including water required for irrigation systems testing and landscape watering through the 90-day maintenance period. No additional compensation will be paid therefor. In accordance with Section 4-10, "Changes," no separate or additional compensation for developing and furnishing additional water will be made for any increase or decrease in the quantity of water required, regardless of the reason for such increase or decrease.

SECTION 18 - DUST PALLIATIVE

Dust palliative shall be as specified in Section 18, "Dust Palliative," of the State Standard Specifications except that, in accordance with Section 17, "Water Use," of these Standard Specifications, no additional payment will be made for water used in making or applying Dust Palliative.

SECTION 19 - EARTHWORK

19-1 General

19-1.01 Description

This work shall consist of all excavation, grading, removal and replacement of material, placement of embankment, subgrade preparation and compaction and all other operations required in the construction of the finished earth surface for roadways and other surface improvements, including performing all operations necessary to excavate all materials, regardless of character and subsurface conditions, from the roadway or areas adjacent thereto; excavation, backfill, compaction, and restoration of surfaces of trenches for the placement of pipelines, conduits and other utilities including, but not limited to, pipelines for sewer, water, non-potable water, storm drains, irrigation, and fiber optic conduits; excavation, backfill, compaction, and restoration of surfaces for the construction or installation of structures; excavation of drainage and irrigation ditches and channels; excavation of selected material from the roadway and borrow material for use as specified; construction of embankments, including the placing of selected material and imported borrow in connection therewith as specified; backfilling holes, pits and other depressions within the roadway area; applying water; removing and replacing unsuitable material; excavating and grading road approaches, driveways, and connections; removal of unstable material outside the roadway prism; preparation of basement material for the placing of other material thereon; all as shown on the Plans and Standard Drawings, as specified in the Specifications, and as directed by the Engineer; and furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work that may be required to construct and maintain the roadway, pipeline, or other facilities requiring earthwork.

For purposes of this Section 19, “roadway” shall include streets, alleys, easements, trails, parking lots, park sites, or the sites of other surface improvement work. Whenever reference to finished grade or finished surface is made, it shall be considered to be the finished surface of the completed facility.

All hauling of material from, to, or on the job site shall comply with Section 6-12, “Materials Hauling.” Where loads are not required to be covered, if directed by the Engineer, the loads shall be watered after trimming to eliminate dust as provided in Section 10, “Dust Control.” The Contractor shall comply with the provisions of Sections 5-9, "Preservation of Property,” and 5-10, "Protection of the Work,” and Section 15, “Removing Existing Facilities,” relative to protection and preservation of property, the work, and other utilities in performing earthwork operations.

Quantities of all types of existing subbase, base, surfacing, or pavement removed will be included in the quantities of the type of excavation in which they are located, and no separate payment will be made therefor.

Clearing and Grubbing for earthwork operations shall conform to the provisions in Section 16, “Clearing and Grubbing.”

Applying water for earthwork operations shall conform to the provisions in Section 17, “Water Use.”

19-1.02 Protection Of Property

The Contractor shall comply with the provisions of Section 5-3, “Contractor’s Responsibility for the Work,” Section 5-9, “Preservation of Property,” Section 7-4, “Contractor’s Insurance Requirements and Hold Harmless,” Section 7-16, “Injury or Damage to Persons or Property,” and Section 8-15, “Utility and Non-Street Facilities; Potholing.” Operations shall be conducted in such a manner that existing roadway or other facilities, utilities, railroad tracks, and other non-street facilities which are to remain in place, shall not be damaged. The Contractor, at the Contractor’s expense, shall furnish

and install sheet piling, cribbing, bulkheads, shores or whatever means may be necessary to adequately support material carrying the facilities, or to support the facilities themselves and shall maintain the supports until they are no longer needed. Temporary pavements, facilities, utilities and installations shall also be protected until they are no longer required. When temporary supports and other protective means are no longer required, they shall be removed and disposed of as provided in Section 5-12, "Disposal of Material Outside the Right of Way."

19-1.03 Grade Tolerance

The grading plane shall not vary consistently above or below the design grade. Except for cuts made for roadway prisms, the tops and ends of cuts shall be rounded as directed by the Engineer.

Immediately prior to placing subsequent layers of material thereon, the grading plane shall conform to one of the following:

A. When asphalt concrete or asphalt concrete base, or concrete, is to be placed on the grading plane, the grading plane at any point shall not vary more than 0.05-foot above or below the grade established by the Engineer.

B. When subbase or base material (other than asphalt concrete base) to be placed on the grading plane is to be paid for by the ton, the grading plane at any point shall not vary more than 0.10-foot above or below the grade established by the Engineer.

C. When the material to be placed on the grading plane is to be paid for by the cubic yard, the grading plane at any point shall be not more than 0.05-foot above the grade established by the Engineer.

19-1.04 Removal And Disposal Of Buried Man-Made Objects

If a buried man-made object encountered in excavation is to be removed and its removal and disposal is not included in another item of work, the removal and disposal will be paid for at the contract price per cubic yard for the type of excavation in which the object is encountered, i.e., roadway excavation, trench or structure excavation, etc. However, if the presence of the object is not indicated on the plans or in the Contract Specifications and its presence could not have been ascertained by visual inspection, the removal and disposal of the object will be paid for as extra work as provided in Section 4-11, "Extra Work," instead of at the applicable contract item price if the Contractor so requests in writing. The request shall be made prior to removal. Unless otherwise specified in the Contract Specifications, no blasting of any kind will be permitted.

Where backfill of a cavity or depression resulting from removal of a buried manmade object is required, it will be paid for in accordance with Section 15, "Removing Existing Facilities," or Section 16, "Clearing and Grubbing," except that backfill for objects removed from within trench or structure excavations will not be paid for separately but included in the price paid for the pipe, conduit or structure requiring the excavation. Where the buried object is not shown on the plans and could not reasonably be ascertained from the surface, and backfill is required but not covered by any other item of work, and the cavity is not located in a trench or structure excavation, payment for backfill shall be made in accordance with said Section 4-11, "Extra Work."

19-2 Roadway Excavation

19-2.01 General

Roadway excavation shall consist of all excavation involved in the grading and construction of the roadway, except trench and structure excavation, ditch or channel excavation and any excavation

separately designated and paid for as a separate item. Unless otherwise specified in the Contract Specifications, Roadway Excavation shall include excavation, removal, and disposal of all material located within the prism of the roadway to be constructed as shown on the plans. "Roadway" shall have the meaning ascribed by Section 19-1.01, "Description."

19-2.02 Unsuitable Material

Unsuitable material encountered below the natural ground surface in embankment areas or below the grading plane in excavation areas shall be excavated and disposed of as directed by the Engineer. Unsuitable material is defined as material the Engineer determines to be:

A. of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content; or

B. too wet to be properly compacted and circumstances prevent suitable in-place drying prior to incorporation into the work; or

C. otherwise unsuitable for the planned use.

The presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable.

The removal and disposal of unsuitable material will be paid for as ~~roadway excavation for the quantities involved if the removal of the unsuitable material is shown on the plans or~~ specified in the Contract Specifications.

~~If the removal of the unsuitable material is not shown on the plans or specified in the Contract Specifications, the removal and disposal of the unsuitable material will be paid for at the contract price for roadway excavation for the quantities involved unless either the Engineer, prior to removal of any unsuitable material, orders the unsuitable material to be removed and disposed of and paid for as extra work as provided in Section 4-11, "Extra Work," or the Contractor, prior to removal of the unsuitable material, requests in writing that the removal and disposal of the unsuitable material be paid for as extra work as provided in said Section 4-11. However, no payment will be made for removal and replacement or re-working of unsuitable material if such condition is deemed by the Engineer to have been caused by the Contractor's operations such as, but not limited to, over-watering.~~

When unsuitable material is removed and disposed of, the resulting space shall be backfilled with material suitable for the planned use. Unless otherwise specified or directed by the Engineer, the material shall be either material conforming to Section 19-2.06, "Selected Material," or conforming to Section 19-4.02, "Imported Borrow." The backfill material shall be placed and compacted in accordance with Section 19-4, "Embankment Construction."

19-2.03 Slopes

Excavation and embankment slopes shall be constructed in conformance with the lines and grades shown on the plans. When completed, the average plane of the slopes shall conform to the slopes indicated on the Plans and no point on the completed slopes shall vary from the designated slopes by more than 0.1-foot measured at right angles to the slope. The tops of excavation slopes and the ends of excavations shall be rounded as shown on the plans or as directed by the Engineer.

19-2.04 Surplus Material
Unless otherwise shown on the Plans or specified in the Contract Specifications, surplus excavated material shall be disposed of outside the right of way in accordance with Section 5-12, "Disposal of Material Outside the Right of Way." The Contractor shall not borrow or waste material unless authorized in writing by the Engineer.

If the quantity of surplus material is shown on the Plans or specified in the Contract Specifications, the quantity shown or specified is approximate only. The Contractor shall be satisfied that there is sufficient suitable material available for the completion of any embankments before disposing of any material outside the right of way. Any shortage of material, caused by premature disposal of any material by the Contractor, shall be replaced by the Contractor and no compensation will be allowed the Contractor for such replacement.

19-2.05 Deficiency Material
If the quantity of acceptable material from excavation is not sufficient to construct the embankments required by the work, the quantity of material needed to complete the embankments shall consist of imported borrow conforming to Section 19-4.02, "Imported Borrow," as shown on the Plans, or specified in the Contract Specifications, or as determined by the Engineer.

The Contractor shall obtain the imported borrow in conformance with the provisions in said Section 19-4.02. If the contract does not include an item for imported borrow, payment for the required imported borrow will be made by extra work as provided in Section 4-11, "Extra Work."

19-2.06 Selected Material
Selected material shall be defined as material which is excavated from a location within the right of way as specified in the Contract Specifications or shown on the plans, and the Contractor shall have no choice in the selection.

Selected material shall be used as shown on the plans or specified in the Contract Specifications. Topsoil excavated within the limits of the project shall be considered as selected material. Selected material not used for topsoil may be used as backfill for filling holes, pits or other depressions caused by removal of existing facilities in conformance with Section 15, "Removing Existing Facilities," Section 16, "Clearing and Grubbing," Section 19-1.04, "Removal and Disposal of Buried Man-Made Objects," or Section 19-2.02, "Unsuitable Material." Selected Material used for backfill or embankment construction shall comply with Section 19-4.02, "Imported Borrow."

When selected material is shown on the Plans or designated in the Contract Specifications as a specified layer in the roadway prism, spreading and compacting the material shall conform to the provisions in Section 25, "Aggregate Subbases," of the State Standard Specifications. When practicable, and processing is not specified, selected material shall be hauled directly from excavation to its final position in the roadway prism and compacted in place and the work will be paid for at the contract price for roadway excavation.

When practicable, selected material shall remain in place until it can be excavated and placed in final position as provided above. No additional compensation will be allowed for any delay or inconvenience in excavation operations, except that if ordered in writing by the Engineer, selected material may be excavated and stockpiled at locations designated by the Engineer and later placed in final position in the roadway prism.

Excavating selected material and stockpiling, if required, will be paid for at the contract price for roadway excavation. Removing the selected material from stockpiles for later placement in its final

position will not be paid for. Placement and compaction will be paid for at the unit price bid for the type of construction requiring the use of selected material. No payment for stockpiling of selected material will be made.

19-2.07 Subgrade Preparation, Compaction

Reference is made to Sections 1-4, "Basement Material," 1-19, "Grading Plane," and 1-44, "Subgrade." Unless otherwise shown on the Plans or specified in the Contract Specifications, for streets divided by a concrete median island, the grading plane extends from the back of the concrete curb and gutter adjacent to the outside travel lane, parking lane, or bicycle lane (the "outside curb and gutter"), to the back of the concrete median curb. For streets not divided by concrete median island, the grading plane extends from the back of one outside curb and gutter to the back of the opposite outside curb and gutter. For alleys, trails, paths, or other places to receive an improved surface, the grading plane shall extend 12 inches beyond (right of way permitting) either side of the planned finish surface.

The preparation and compaction of the subgrade below the grading plane to receive subbase, aggregate base, asphalt-concrete, concrete or other paving materials shall consist of the following:

The soil material beneath the grading plane shall be bladed or disked to a depth of 6 inches and all rocks, hardpan chunks or otherwise unsuitable material over 2 inches in greatest dimension, shall be removed and disposed of off the project site in accordance with Section 5-12, "Disposal of Material Outside the Right of Way."

The material thus disced or bladed shall be thoroughly mixed, watered and rolled to a smooth and even condition to a relative compaction of not less than 95 percent in compliance with Sections 6-8, "Samples and Tests," and 6-9, "Compaction Tests," to a depth of not less than 6 inches below the grading plane or as otherwise shown on the Plans or Standard Drawings or specified in the Contract Specifications.

Any soft, spongy or otherwise unstable areas shall be repaired by completely removing the material and replacing it with acceptable materials in accordance with these Specifications, at the Contractor's expense. Before subbase, aggregate base, asphalt-concrete, concrete or other paving material is placed, the Engineer may require, at the Contractor's expense, a test roller of size and weight as approved by the Engineer to pass over the finished subgrade to ascertain that there are no such soft or spongy areas.

No subsequent layer of a structural section shall be placed until the finished subgrade is in a stable condition satisfactory to the Engineer, regardless if said subgrade passed any prior compaction test. Any trenches cut for pipelines or conduit installation after the subgrade or any other layer of the roadway prism has been stabilized, shall be compacted in compliance with Section 19-3.03(E), "Compaction," herein. It shall be the Contractor's responsibility to assure that others doing work within the area under his control, including subcontractors, utility and communications contractors, comply with this provision.

The relative compaction of the top 6 inches of subbase under curb returns including the landing, driveway approaches including adjacent sidewalk, valley gutters, paved trails, and alleys shall be no less than 95 percent.

No compaction test of subgrade shall be made until such time as the subgrade is finished to within 1 inch (high) of finished subgrade. The Contractor shall notify the Engineer when the subgrade is ready for compaction testing, and the City Engineer will notify the appropriate testing laboratory designated

to perform such tests. The Engineer shall specify the locations where compaction tests are to be made.

No excavation shall be made below the plane of the bottom of curb or curb and gutter subsequent to installing curb or curb and gutter until backfill has been placed behind the curb.

19-2.08 Measurement

The following earthwork operations will be measured and paid for as roadway excavation for the quantities of material involved and no additional compensation will be allowed therefor:

Excavating the roadway prism to the grading plane including slope rounding, public and private road approaches, connections and driveways; excavating unsuitable material when shown on the plans or specified in the Contract Specifications; excavating surplus material; excavating selected material and topsoil from within the limits of the project; and excavating drainage and irrigation ditches and channels.

Quantities of roadway excavation will be computed by means of average areas and distances between these areas, except as provided in the following paragraph.

Where due to changed conditions or the nature of a particular operation or for any other reason, it is impossible or impractical to measure quantities of roadway excavation by means of average areas, the Engineer will compute the quantities of material excavated by a method which in the Engineer's opinion is best suited to obtain an accurate determination.

When quantities of roadway excavation are computed by means of average end areas and center line distances, a correction for curvature will not be applied to quantities within the roadway prism. In computing the quantity of material outside the original roadway prism, where the roadway center line is used as a base, correction will be made for curvature if the center line radius is 1,000 feet or less.

Excavation in excess of the planned or authorized cross section will not be paid for. The Contractor shall backfill and compact as directed by the Engineer unauthorized excavated areas to the original ground elevation or authorized section at the Contractor's expense.

19-2.09 Payment

Quantities of roadway excavation, measured as specified in Section 19-2.08, "Measurement," will be paid for at the contract price per cubic yard. That price shall include excavating, sloping, rounding tops and ends of excavations, loading, hauling and depositing within the work site, hauling and disposing of material outside the right of way, spreading and compacting the material complete in place, and preparing subgrade at the grading plane as specified in Sections 19-1.03, "Grade Tolerance," and 19-2.07, Subgrade Preparation, Compaction."

The above price and payment shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in performing roadway excavation work completely as shown on the Plans, specified in the Specifications, and as directed by the Engineer.

19-3 Trench And Structure Excavation, Backfill, And Surface Restoration

19-3.01 General

This work shall consist of all excavation, backfill, and compaction necessary for the construction or installation of underground pipelines, conduits, structures and other facilities, and the replacement or restoration of surfaces disturbed by such work, all as set forth in the Plans, Standard Drawings, the Specifications, and as directed by the Engineer. As a minimum, structures shall include manholes, storm drain inlets, water valve boxes, and vaults of any kind.

Backfill, compaction, and surface restoration of potholes or other excavations performed to determine the location of underground utilities or facilities as required by Section 8-15, "Utility and Non-Street Facilities; Potholing," shall conform to the applicable portions of this Section 19-3 and to the special backfill requirements of said Section 8-15.

19-3.02 Trench And Structure Excavation

Excavations shall be made to the depths and widths required to accommodate the construction or installation of pipelines, conduits and structures to specified dimensions and to the lines and grades shown on the Plans.

The Contractor shall comply with the provisions of Sections 7-12, "Safety Provisions; First Aid; Injury/Illness Prevention Program," 7-13, "Worker Protection From Toxic Or Explosive Gases, Confined Spaces Entry," and 7-15, "Worker Protection From Caving Ground In Excavations," and all Safety Orders issued by the State Division of Industrial Safety. Material excavated from trenches or for structures shall be placed to offer minimum obstructions to traffic.

The City has made every effort to locate and show all underground utilities and facilities on the plans. However, before excavation, the Contractor shall be responsible to field verify the locations by calling for USA mark-outs, potholing, and any other means or methods to determine both the horizontal and vertical locations of underground utility and other facilities, and shall notify the Engineer immediately if conflicts occur. The Contractor shall comply with the provisions of Section 8-15, "Utility and Non-street Facilities; Potholing," relating to existing utilities, and the location and protection thereof. The location of subsurface obstructions found in the field may necessitate a variance in the depth or alignment of proposed facilities.

When a trench or structure site is to be located in an existing oiled earth or pavement area, the existing surfacing to be removed shall be cut by methods shown on the plans or as approved by the Engineer along neat lines on each side of the trench or around the structure site. Existing surfacing, when removed, shall be kept separated from the material that is to be returned to the excavation as backfill. Failure to comply with this requirement shall be grounds for rejection of the contaminated material for use as backfill.

Trenches shall be uniformly graded and prepared to provide a firm and uniform bearing for the entire length of the barrel of the pipe to be placed therein. Coupling or bell holes are required for all trenches to receive pipes or conduits with couplings or bells, and shall be excavated at each location where pipes are to be joined. Coupling or bell holes shall be of sufficient and of adequate size to permit ease in making the joint and so the coupling or bell does not rest on the bottom of the hole excavated therefor. Except for pipe bells and couplings, any portion of the trench excavated below the approved grade shall be corrected and brought up to grade with approved material thoroughly compacted.

Trenches bottoming in hardpan shall be over-excavated a minimum of 6 inches below the grade established for the bottom of the pipe and any bells or couplings and then backfilled to the design pipe grade with select material and thoroughly compacted. No additional payment will be made for such over-excavation, backfill, and compaction.

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 a minimum depth of 12 inches or to a depth determined by the Engineer, below the normal bottom of the trench or structure excavation. The over-excavated space shall be 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 herein or as required by the Engineer for pipelines, conduits, or structures. No additional payment will be made for such additional excavation or backfill.

The width of the trench from the bottom to the top of the pipe or conduit shall be a minimum of 6 inches but no more than 12 inches on either side of the pipe, or per the pipe manufacturer's recommendations. The Contractor shall make every effort to minimize the width of the trench at the top of the trench. Excessive trench widths, as determined by the Engineer, may require special trench and pipe backfill methods to counteract excessive pipe loads and provide a bond between backfill and trench walls. Reference is made to Sections 19-3.03(A)2, "Final Backfill, Precast Pipe," and 19-3.03(A)3, "Backfill, Cast-in-Place Pipe." No additional payment will be made for such special backfill methods for failure of the Contractor to exercise good construction practices to minimize trench widths.

Trenches for cast-in-place concrete pipe shall be graded and prepared to provide full, firm and uniform support by undisturbed earth or compacted fill throughout the bottom 220º of the pipe periphery.

The Contractor shall be responsible for drainage of trenches and other excavation areas, and such areas shall be kept as dry as practicable throughout the construction period. Pumping or other approved method shall be used to remove any accumulation of water. Trenches damaged because of failure to provide temporary drainage control shall be repaired or reconstructed at the Contractor's expense. The Contractor shall adhere to the provisions of Section 5-16, "Maintaining Drainage." No drainage water may be pumped or otherwise deposited in any sanitary sewer system, unless otherwise approved by the Engineer.

19-3.03 Trench And Structure Backfill And Compaction

Unless otherwise specified, material used for trench or structure backfill shall be granular native material, free from debris, lumps, hardpan chunks, paving material or organic matter of other deleterious or unsuitable substances. Material shall be approved by the Engineer before use in the work.

19-3.03(A) Trench Backfill

Backfill of trenches shall conform to the Standard Drawings pertaining thereto, these Standard Specifications, and the directions of the Engineer. Backfill for trenches in which precast pipe, including utility or communications conduits, has been installed shall be placed in two phases, classified as Initial Backfill and Final Backfill.

19-3.03(A)1 Initial Backfill, Precast Pipe, Conduit

After the precast pipe or conduit has been laid to line and grade, Initial Backfill shall consist of placing by hand and firmly compacting selected native material under the haunches and up to the

spring line of the pipe so as to form a firm bedding, and then filling with selected native material and compacting to a level 12 inches above the top of the pipe. The method of compacting and obtaining density requirements for initial backfill shall be such that the line and grade of the pipe is not disturbed and the pipe is not damaged. Selected native material shall be granular, free of all rocks, hardpan, paving material, organic matter or other deleterious substances. Jetting of Initial Backfill to completely fill the space under pipe haunches may be permitted by the Engineer, depending on soil conditions and type.

19-3.03(A)2 Final Backfill, Precast Pipe, Conduit

Final Backfill for trenches in which precast pipe or conduit has been placed shall consist of placing and compacting 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 0.67 foot in depth (loose), and compacted. Each lift shall be compacted the full depth of the lift prior to placement of the next lift of backfill material. Jetting of final backfill will not be permitted. In cases of excessive trench width, soil conditions, and soil type, as determined by the Engineer, to assure proper pipe load distribution and bonding between trench backfill and trench walls, the Contractor may be required by the Engineer to bench, plow, or scarify trench walls prior to placement of backfill. The cost for such trench wall treatment, if so required, shall be included in the price paid per linear foot of pipe. No additional payment will be made therefor.

19-3.03(A)3 Backfill, Cast-in-Place Pipe

Backfill material for trenches in which cast-in-place concrete pipe has been constructed shall be returned to the trench in lifts not to exceed 0.67 foot in depth. Depending on soil condition and type, and upon satisfactory demonstration to the Engineer that the methods proposed by the Contractor achieve the required consolidation and compaction results, the thickness of lifts may be increased by the Engineer, but in no case shall lifts exceed 3 feet loose depth. In no case shall backfill material be allowed to free-fall directly onto the pipe. Initial backfill efforts may proceed no sooner than 48 hours after construction of the pipe, except that compaction efforts using equipment which imparts load on the pipe or structures, shall not proceed for a minimum of seven (7) calendar days following placement of the pipe unless this requirement is specifically waived by the Engineer, or is otherwise specified. Each lift shall be compacted prior to placement of the next lift of backfill material. In cases of excessive trench width, soil conditions, and soil type, as determined by the Engineer, to assure proper pipe load distribution and bonding between trench backfill and trench walls, the Contractor may be required by the Engineer to bench, plow, or scarify trench walls prior to placement of backfill. The cost for such trench wall treatment, if so required, shall be included in the price paid per linear foot of pipe. No additional payment will be made therefor.

19-3.03(B) Structure Backfill

Structure backfill shall consist of placing and compacting backfill material around structures to the lines designated on the Plans or directed by the Engineer. Where cast-in-place structures are constructed, no backfill shall be placed until all forms are removed, all voids in the concrete properly filled, and the exterior of the structure has been inspected by the Engineer and approved for backfilling. Backfill material shall be placed in lifts not to exceed 0.67 foot in loose depth and compacted. Depending on soil condition and type, and upon satisfactory demonstration to the Engineer that the methods proposed by the Contractor achieve the required consolidation and compaction results, the thickness of lifts may be increased by the Engineer, but in no case shall lifts exceed 3 feet loose depth. Each lift shall be compacted prior to placement of the next lift of backfill material.

19-3.03(C) Slurry Cement Backfill
Where specified in the Plans or Contract Specifications, and as specified in Section 8-15, "Utility and Non-Street Facilities; Potholing," for backfill of small diameter excavations, slurry cement backfill shall be furnished and placed in conformance with Section 19-3.062, "Slurry Cement Backfill," of the State Standard Specifications.

19-3.03(D) Pervious Backfill Material
Where specified in the Plans or Contract Specifications, Pervious Backfill Material shall be furnished and placed in conformance with Section 19-3.065, "Pervious Backfill Material," of the State Standard Specifications.

19-3.03(E) Compaction
Compaction shall conform to the requirements of Section 6-9, "Compaction Tests," and the applicable Standard Drawings for Trench Backfill and Resurfacing. All trench and structure backfill, including that for utility or communications conduit whether installed under City Contract or Encroachment Permit, shall be compacted to a relative compaction of not less than 90 percent to within 24 inches of the bottom of the planned structural section of trench resurfacing, or roadway structural section if the trench or structure is located in a roadway to be reconstructed as part of the work, or the ground surface when the trench or structure is located in an unimproved area. The upper 24 inches of trench and structure backfill shall be compacted to a relative compaction of not less than 95 percent.

For trenches or areas around structures that are to receive an improved surface, the compacted backfill shall be brought to a smooth and level condition so as to receive the full thickness of surfacing. Where the trench or area around a structure is not to be resurfaced, the surface of compacted backfill shall be brought to a smooth condition even with adjacent undisturbed soil. The surface of the finished backfill in all areas shall be made even and uniform, free from depressions or raised areas.

Excess material resulting from backfill and compaction of trenches and structures not used in the work shall be disposed of outside the right-of-way as set forth in Section 5-12, "Disposal of Material Outside the Right of Way."

19-3.03(F) Water
The use of water in the work shall comply with the requirements of Section 5-13, "Electric and Water Service," and Section 17, "Water Use." Where the City's water system is utilized for construction water, the Contractor shall obtain a water meter from the City of Clovis (fire hydrant meter are required for all users). The Contractor shall obtain the permission of the Engineer as to which fire hydrants are to be utilized. Except as provided in Section 19-3.03(A)1, "Initial Backfill, Precast Pipe" jetting of trench backfill is not allowed. Flooding of trenches from the top is not permitted.

19-3.04 Progress Of Work, Trench And Structure Excavation, Backfill
All work of excavation and backfilling shall be done as quickly as possible.

Where trench or structure excavation is to occur in an area with improved surfacing, the existing surfacing at any location shall be removed no sooner than 48 hours prior to excavation at that location. No surfacing shall be removed on Friday unless excavation and follow-up work will occur the same day.

Unless authorized in writing by the Engineer, no more than 650 feet of trench shall be excavated at any location ahead of any preceding trench which has not received pipeline or other conduit and backfilled.

No excavation or trench shall be opened and left open more than 24 hours before: a) the installation of the pipeline or other conduit which is to be placed in said trench; b) the start of construction of a structure in said excavation. The backfilling of said excavation or trench shall be completed within twenty four hours after the installation of the facility for which the excavation was made, except for cast-in-place pipe installations and that portion of trenches or excavations to be used for connecting the extension of the installation, provided said portion is adequately barricaded and protected, and backfilled the following working day.

Backfill for cast-in-place concrete pipe shall be accomplished as soon as practicable but shall comply with the timing requirements of Section 19-3.03(A)3, "Backfill, Cast-in-Place Pipe." Trenches shall be adequately barricaded and access shall be provided for abutting properties and street intersections.

Unless otherwise specified in the Contract Specifications or authorized in writing by the Engineer, where an excavation or trench crosses a street intersection, the excavation, installation, and backfill or bridging shall be conducted in a manner such that the street shall remain open at all times. Alleys may be closed, but shall be reopened at the end of the work day.

All excavations located within a street or alley for the purpose of boring or jacking pits shall be properly barricaded and protected, and may be left open for a period of not more than seven (7) calendar days, unless an extension of time is approved by the Engineer in writing.

Immediately after trenches or other excavations have been backfilled and preliminarily compacted at street or alley crossings, temporary surfacing shall be placed in conformance with Section 19-3.05, "Restoration of Surfaces," and in accordance with the Plans and Standard Drawing therefor.

19-3.05 Restoration of Surfaces

For trench or structure excavations located in existing paved areas not to be reconstructed as part of the work, final pavement replacement shall be accomplished as soon as possible and practicable, but in no case less than the time limits specified in the Contract Specifications.

Restoration of surfaces shall consist of restoring the surfaces (resurfacing) of all trenches and surfaces at or around structure sites, or any other surfaces damaged or disturbed by the work. Surfaces shall include pavement of any kind including asphalt concrete, portland cement concrete, paving stones, grass, shrubbery or other landscaping, gravel, treated or untreated soil, etc. All work shall be done in accordance with the Plans, Standard Drawing, and the Specifications.

Temporary trench resurfacing shall comply with the applicable Standard Drawing for Trench Backfill and Resurfacing and placed and diligently maintained by the Contractor until permanent trench resurfacing is installed. Temporary surfacing shall be placed at all street and alley crossings, and such other locations as specified or shown on the Plans, or directed by the Engineer. Temporary surfacing shall be removed by the Contractor prior to placing final resurfacing.

Final replacement of pavement shall be performed in a manner consistent with good construction practices and methods which, when completed, shall leave all areas requiring replacement of pavement with as neat an appearance as possible. Areas to receive final 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 6 feet 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 sawcutting of existing pavement edges is not shown on the standard drawing or specified, all damaged existing pavement shall be removed and the edges trimmed to neat lines as directed by the Engineer and by a method approved by the Engineer.

Where sawcutting of existing pavement edges is shown on the standard drawing or 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 3 inches in depth, and shall encompass all pavement damaged by the work or specified to be removed or replaced.

All edges of existing pavement, whether trimmed or sawcut, 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. No additional payment will be made therefor.

Where Aggregate Base is specified to be used as part of the resurfacing structural section or backfill, it shall be furnished and placed in conformance with Section 26, "Aggregate Bases," of the State Standard Specifications.

Where Portland Cement Concrete is specified to be used as part of the resurfacing structural section or backfill, unless otherwise specified on the Plans or in the Contract Specifications, it shall be Class 1, 2, 3, or 4 with 1 inch maximum aggregate, conforming to the requirements of Section 90**, "**Portland Cement Concrete," of the State Standard Specifications. The top surface of the concrete shall be given a rough rake finish while the mix is still workable with the corrugations parallel with the trench. Where called for on the Plans or Specifications or directed by the Engineer, calcium chloride of up to 2 percent by weight of the cement shall be added to the concrete mix.

A paint binder of asphaltic emulsion shall be furnished and applied, in conformance with Section 39-4.02, "Prime Coat and Paint Binder (Tack Coat)," of the State Standard Specifications, to all vertical or other 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.

Asphalt concrete shall be furnished and placed in conformance with Section 39, "Asphalt Concrete," of the State Standard Specifications. When replacing pavement in existing paved areas, the new pavement shall be placed in accordance with the Standard Drawings therefor which shall apply to replacing pavement around structures as well as within trenches. The Contractor shall not commence surface paving until the subbase and/or base have been inspected and approved. Violation of this requirement shall be cause for rejection of that portion of paving involved.

When compacted, the new pavement edge shall be flush with the existing pavement and edge of adjacent concrete improvements where applicable. The surface shall be smooth, without humps or depressions. Except where the trench is located in the crown of the road, the top of the finished surfacing shall deviate no more than ¾ inch higher, and in no case lower, than a line struck off from two points on the existing road surface, one on each side of the trench. Deviation from this tolerance shall be cause for rejection of the surfacing.

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

gravel, oiled dirt, concrete, or soil, all as directed by the Engineer. 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.

In all cases regardless of surface material or type, all existing or new facilities shall be brought to the finish grade of that surface in compliance with Section 15-2.05(A), "Frames, Covers, Grates, Manholes." The interior of the existing or new facilities, including water valve barrels, shall be thoroughly cleaned of all debris or dirt, regardless of whether the debris or dirt was present before construction began.

Restoration of surfaces shall comply with Sections 4-13, "Interim Cleanup," 5-20, "Surface Restoration," and 5-21, "Final Cleanup."

19-3.06 Measurement

Trench and structure excavation will not be measured as it is to be included in the work requiring such excavation and backfill. Unless otherwise provided in the Contract Specifications, measurement of Slurry Cement Backfill or Pervious Backfill Material used for trench backfill shall be by lineal foot as measured along the centerline of trench in which such backfill was placed.

Measurement for temporary or permanent trench resurfacing will be by the lineal foot as measured along the centerline of the actual trench resurfaced, unless otherwise indicated in the Plans and/or Contract Specifications. Regardless of composition or combination of materials used in trench resurfacing, measurement will be as though only one material is used. Measurement of resurfacing around structures will not be made, as no separate payment will be made therefor.

Unless otherwise specified in the Contract Specifications, restoration of miscellaneous surfaces for trenches or structures will be included in the cost of the various items of work, and no measurement will be made.

Measurement of facilities raised to grade shall be in accordance with the contract item therefor. In the absence of a contract item(s) for the measurement and payment of raising existing and/or new facilities to grade within the trench surface restoration area, no measurement will be made, and payment therefor shall be included in the various items of work.

19-3.07 Payment

Except for Slurry Cement Backfill and Pervious Backfill Material, payment for trench and structure excavation, backfill and compaction, including any benching, plowing, or scarifying required by the Engineer shall be included in the amount bid for installing the pipe, conduit, structure or other facility to be installed in such trench or other excavation. Payment shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals including water, and for doing all the work involved as shown on the Plans, as set forth in these Specifications, the Contract Specifications, and as directed by the Engineer.

The unit price paid for Slurry Cement Backfill and Pervious Backfill Material shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved as shown on the Plans, as set forth in these Specifications, the Contract Specifications, and as directed by the Engineer.

Unless otherwise provided in the Contract Specifications, the unit price bid per lineal foot for temporary or final trench resurfacing shall include full compensation for furnishing all labor,

materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans and Standard Drawings, as set forth in these Specifications, the Contract Specifications, and as directed by the Engineer, including maintaining temporary surfacing and removing it prior to final resurfacing, sawcutting or trimming existing pavement edges, and application of tack coat. No payment will be made for temporary or permanent resurfacing, or sawcutting existing pavement therefor, around structures; the cost thereof shall be included in the price paid for the structure involved.

When the Contract does not include a pay item for temporary or final trench resurfacing as above specified, and unless otherwise provided in the Contract Specifications, full compensation for any necessary temporary or final trench resurfacing including required sawcutting shall be considered as included in the prices bid for the other various items of work and no separate payment will be made therefor.

Unless otherwise provided in the Contract Specifications, full compensation for restoration of miscellaneous surfaces shall be considered as included in the price bid for the various items of work and no separate payment will be made therefor.

19-4 Embankment Construction

19-4.01 General

Embankment construction shall consist of constructing roadway embankments, including the preparation of the areas upon which embankment materials are to be placed; the construction of temporary surcharge embankment above the grading plane; the construction of earthen dikes within or outside the right of way; the placing and compacting of approved material within the areas to receive embankment where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits and other depressions within the area to receive embankment. Embankment material shall be either selected material conforming to Section 19-2.06, “Selected Material,” or imported borrow conforming to Section 19-4.02, “Imported Borrow.”

19-4.02 Imported Borrow

The Contractor shall, at his expense, make his own arrangements for obtaining imported borrow and pay all costs involved. Imported borrow shall be of a quality suitable for the purpose intended, free of vegetable matter or other unsatisfactory material, and shall have a minimum R- value of 55 as determined from tests conducted in accordance with Section 6-8, “Samples and Tests.” Selected material from excavation or imported borrow material having a Sand Equivalent value less than 10 shall not be placed within 2.5 feet of finished grade and shall be placed in the lower portions of embankments. Clods or hard lumps of earth over 8 inches in greatest dimension shall be broken up before compacting the material in embankment. Large rocky material, including rocks, broken concrete or other solid materials, or hard lumps such as hardpan or cemented gravel, which cannot be broken readily shall not be used in embankments. All imported borrow shall be subject to the approval of the Engineer. The Contractor shall supply to the City, at the Contractor's expense, test results required by the Engineer to determine the suitability of any borrow proposed for import. These tests, which are to be representative of the material delivered to the site, will be required at the original site of the proposed borrow material and also at the delivery site. The Contractor shall remove, at the Contractor's expense, any borrow placed which fails to meet the approval of the Engineer.

19-4.03 Placing

Where shown in the Plans or specified in the Contract Specifications, the Contractor shall provide excavation, grading, placement and compaction for the construction of roadway embankment from

approved surplus excavated material (selected material) or from Imported Borrow, to the line, grade and cross-section shown on the Plans, or as directed by the Engineer. Unsuitable surplus excavated material shall be disposed of by the Contractor in accordance with Section 5-12, "Disposal of Material Outside the Right of Way." If the quantity of selected material is not sufficient to construct the embankments required by the Plans, the quantity of material needed to complete the embankments shall consist of Imported Borrow.

Embankments shall be constructed in layers. The loose thickness of each layer of embankment material before compaction shall not exceed 8 inches. Areas to receive embankment construction shall first be cleared of all debris, bushes, weeds, stumps, or other deleterious material, in accordance with Section 16, "Clearing and Grubbing." If embankment material is to be placed on existing slope areas, the existing surface shall be benched, plowed, or scarified in accordance with the plans or as directed by the Engineer to produce a bond with the material to be placed.

Attention is directed to Section 19-4.04, "Compacting." Where embankment is to be made and compacted on slopes or where new embankment is to be compacted against existing embankments or where embankment is built one-half width at a time, the original slopes and old or new embankments shall be cut into a minimum of 3 feet horizontally as the work is brought up in layers. Material thus cut out shall be re-compacted along with the new embankment material at the Contractor's expense, unless the width of excavation required by the Engineer exceeds 3 feet, in which case the excavation of material in excess of 3 feet horizontally will be measured and paid for as roadway excavation.

Where embankment is to be made and compacted on original slopes, old or new embankments, and end dumping is permitted, the slopes of the original ground or embankment shall be benched, plowed or cut into before starting end dumping.

When embankment is to be placed on an existing roadway, the existing roadbed shall be scarified, watered, graded and rolled in advance of placing new material thereon.

The construction of earthen dikes, the placing and compacting of approved material within the right of way where unsuitable material has been removed, and the filling of holes, pits and other depressions within the right of way, shall conform to the provisions herein and in conformance with the provisions in said Section 19-4.04. Trenches, holes, depressions and pits outside of areas where embankments are to be constructed shall be graded to provide a presentable and well-drained area.

Where embankments are shown on the plans to be constructed across low, swampy ground which will not support the weight of hauling equipment, the lower part of the embankment may be constructed by dumping successive loads in a uniformly distributed layer of a thickness not greater than that necessary to support the equipment while placing subsequent layers, after which the remainder of the embankment shall be constructed in layers and compacted as specified.

Embankments shall be maintained to the grade and cross section shown on the plans until the acceptance of the contract.

19-4.04 Compacting

Embankments shall be constructed in layers of uniform thickness as specified in Section 19-4.03, "Placing." Each layer shall be compacted to a relative compaction of not less than 90%, except that any layer within 2.5 feet of finish grade shall be compacted to a relative compaction of not less than 95%.

Sidehill embankments, where the width including bench cuts for bonding existing and new embankments is too narrow to accommodate compacting equipment, may be constructed by end dumping if permitted by the Engineer, until the embankment, including benching, is wide enough to permit the use of compacting equipment, after which the remainder of the embankment shall be placed in layers and compacted as specified.

At the time of compaction, the moisture content of embankment material shall be such that the specified relative compaction will be obtained and the embankment will be in a firm and stable condition. Embankment material which contains excessive moisture shall not be compacted until the material is dry enough to obtain the required compaction. Full compensation for any additional work involved in drying embankment material to the required moisture content shall be considered as included in the contract price paid for excavating or furnishing the material and no additional compensation will be allowed therefor.

Any subsequent trenching through completed embankments, including trenching for utility or communications conduits, shall comply with Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration." The Contractor shall assure that others doing work within the area under the control of the Contractor comply with this requirement.

19-4.05 Measurement

Where embankment construction is shown on the Plans, measurement shall be by the cubic yard. Where embankment construction is included as backfill for other contract items of work, no measurement will be made.

19-4.06 Payment

The unit price paid for Embankment Construction shall include full compensation for furnishing all equipment and performing all work required for clearing, subgrade preparation for placing embankment, including placing and compacting approved material where unsuitable and unstable embankment foundation material has been removed, benching, plowing, or scarifying as required, excavation, hauling, placing and compacting local or imported borrow, and finish grading to the lines and grades shown on the plans.

Filling and compacting holes, pits and other depressions, backfilling excavations resulting from the removal of structures and other facilities, or replacement of unsuitable material will be paid for in accordance with Section 15, "Removing Existing Facilities," Section 16, "Clearing and Grubbing," and Section 19-2.07, "Subgrade Preparation, Compaction."

SECTION 20 - LANDSCAPE PLANTING

20-1 General

20-1.01 Description

Landscape planting shall consist of performing all work necessary for soil and bedding preparation, furnishing, planting, and establishing all forms of landscaping as shown on the Plans, as specified in the Specifications, and in conformance with the applicable Standard Drawings,. The work shall include planting of seed for turf, placing sod, planting trees, shrubs, plants, and ground cover, transplanting trees, plants and shrubs. The work shall also include furnishing all labor, materials such as support posts, straps, and stakes, fertilizer, soil amendments, tools, equipment, and transportation, maintenance and watering of the planted materials during the required plant establishment and maintenance periods, watering for dust control, clean-up of the work site, and any other incidental materials or work required to complete all of the work involved in landscape planting, all as shown on the Plans and as specified in these Specifications, the Contract Specifications, and as directed by the Engineer.

For City contracts, and other non-City work done under Encroachment Permit (private development, including subdivisions), contractors shall comply with Section 5-13, "Electric and Water Service," and Section 17, "Water Use." Contractors will be charged for City water used. This includes water taken through hydrant meters for construction purposes, and water taken through water meters for irrigation system testing and landscape planting up to and including the 90-day maintenance period specified in Section 20-8, "Maintenance Period."

These specifications shall apply to all areas to receive landscape planting including park sites, street median islands, trails or paseos, street park strips, street landscape strips, and any other area shown on the Plans to receive landscape planting.

20-1.02 Inspection

All of the work described herein will be subject to inspections by an Engineering Division inspector and specialized City Parks Division personnel, as ordered by the Engineer. Such specialized inspections will be made of items including, but not limited to, the following:

(a) Grading
(b) Imported soil and soil amendments prior to and during incorporation into work.
(c) Weed control operations prior to planting.
(d) Placement and arrangement of plant materials prior to planting.
(e) Condition of plant material prior to placement.
(f) Digging and preparation of plant holes for trees.
(g) Planting and staking of trees.
(h) Inspection during plant establishment period.
(i) Pre-final Inspection prior to commencement of Maintenance Period
(j) Inspection during plant maintenance period.
(k) Final inspection after completion of the plant maintenance period.

All overtime inspection charges incurred by specialized City Parks Division personnel shall be paid by the Contractor when inspection services are required outside of normal working hours. Work requiring inspection before or after the normal 8 hours of a normal working day or taking place on holidays Saturdays and Sundays will be considered overtime inspection. The Contractor will be billed at the standard City hourly overtime rate. Failure to pay the bill will be cause to deduct the amount from monies due the Contractor.

A pre-final inspection of the work shall be made by the City Engineering Inspector and Parks Division personnel in the presence of the Contractor, at the time when all landscaping and irrigation work is completed and inspection is requested by the Contractor to commence the plant maintenance period. The Contractor shall comply with the requirements of Section 20-8, "Maintenance Period." The Contractor shall make the inspection request to the Engineer two working days prior to the requested time of such inspection.

At the time of the pre-final inspection, the Contractor shall have prepared and transmit to the City Engineering Inspector a set of record or "as-built" drawings of the landscaping and irrigation work.

At the conclusion of the maintenance period, a final inspection shall be scheduled by the Contractor two working days in advance of the requested inspection.

In the event the Contractor schedules an inspection and has not completed the work that is to be inspected or made an effort to do so, the Contractor will be billed at the standard City hourly rate for the cost of time expended by City inspectors in preparing for and making the determination that the work has not been satisfactorily completed to warrant an inspection. If the inspection was scheduled to occur on overtime, a weekend, or holiday, said charge will be calculated at the standard City overtime/double time rate as applicable. Failure to pay the bill will be cause to deduct the amount from monies due the Contractor.

20-1.03 Rough Grading

Before soil preparation is to begin, the entire area that is to receive landscape planting shall be cleared and grubbed in accordance with Section 16, "Clearing and Grubbing," and shall be graded in accordance with Section 19, "Earthwork," to lines and grades as indicated on plans, in the Contract Specifications, or established by the Engineer. If there is no contract pay item for clearing and grubbing, the cost thereof shall be considered as included in the various line items of work.

Prior to grading operations, all woody plant material not removed as part of clearing and grubbing operations, including any remaining shrubs, vines, weeds, or any other unwanted growth, shall be removed.

Unless otherwise directed by the Engineer, areas to be cut or to receive fill shall have the topsoil stripped and stockpiled before grading operations begin in accordance with Section 19-2.06, "Selected Material." Areas to be filled shall be sufficiently compacted to prevent settlement when watered. After completion of the grading operations, the topsoil is to be replaced in areas to receive landscape planting. Excess topsoil shall be disposed of in accordance with Section 5-12, "Disposal of Material Outside the Right of Way." Topsoil or other fill imported to the site, if needed, shall be classified as Imported Borrow in accordance with Section 19-4.02,"Imported Borrow," and paid for at the contract unit price therefor unless otherwise specified in the Contract Specifications.

The cost of Rough Grading shall be included in the unit or lump sum price bid therefor, which shall include all work, equipment and incidentals required for clearing of material not removed as clearing and grubbing, discing, stripping, storing and moving topsoil as required, grading including cut and fill operations as required, watering for dust control, application of weed control, and all other work and incidentals required to bring the site to lines and grades shown on the plans.

New or pre-existing median islands to receive landscape planting shall be cleared of all debris including, but not limited to, asphalt concrete and concrete, and any pre-existing road surfacing or base material between the median curbs shall be removed to the depth of original ground. Reference is made to Section 8-15, "Utility and Non-Street Facilities; Potholing." All debris or pre-existing

roadway materials removed from median island areas shall be disposed of in accordance with said Section 5-12. Removal of debris including pre-existing roadway materials shall be paid for at the contract price for Clearing and Grubbing. In the absence of an item for Clearing and Grubbing, the cost shall be considered as included in the various items of work and no additional payment will be made therefor.

Median islands shall be backfilled with topsoil to the lines and grades shown on the plans. Topsoil imported to fill median areas shall be placed in accordance with these specifications, and be paid for at the contract price for Imported Borrow. In the absence of a contract item for Imported Borrow, the cost of importing topsoil to the work site and placing shall be included in the various items of work; no separate payment will be made therefor. Imported soil shall be amended as provided in Section 20-1.04, "Soil Preparation and Amendment."

20-1.04 Soil Preparation And Amendment

For all areas shown on the Plans or specified in the Contract Specifications to receive landscape planting, the soil shall not be worked when the moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form or that clods will not break readily. Water shall be applied as necessary to provide ideal moisture for filling and for planting as herein specified, and for control of dust in accordance with Section 10, "Dust Control."

In addition to the clearing and grubbing requirements, all areas specified for landscape planting of any kind shall be ripped to a depth of 8 inches to 12 inches so the soil is loose and friable. In areas to receive turf, the top 3 inches of the surface soil shall be cleared of all concrete, stones, asphalt concrete, roots, wire, sticks and any other debris larger than 1inch in greatest dimension. The Contractor shall dispose of all debris in accordance with Section 5-12, "Disposal of Material Outside the Right of Way."

After the area designated to receive landscape planting is rough graded to the lines and grades as shown on the plans, ripped and cleared of debris, and unless otherwise noted in the Plans or Contract Specifications, the Contractor shall amend the soil by using the methods of either Option (1) or Option (2) below. The Contractor shall notify the City Engineering Inspector who will observe the preparation application of soil amendment. Unless otherwise specified in the Contract Specifications, areas designated on the plans to receive tree planting only and no other landscaping shall be roto-tilled but no soil amendment added.

<u>Option 1.</u>

Soil amendment components for all soil types, and application rates:
Black Humus: 20 cubic yards per acre.
Powdered Agricultural Grade Gypsum (15% Calcium, minimum): 2,000 lbs per acre.
M-Roots (Roots, Inc.) or approved equal: 435 lbs per acre.

(a) Notify City Inspector for observation of application and incorporation of soil amendment.

(b) Roto-till soil amendment mix into the soil to a depth of 8 to 12 inches.

Option 2.

(a) Collect representative soil samples from areas to receive landscape planting. Record and stake each sample location and mark samples accordingly.*

(b) Have a Soil Chemical Analysis and Percent Organic Analysis performed on the samples by a certified Soils Testing Lab.

(c) Obtain a Soil Amendment Recommendation from a Certified Crop Advisor based on the Soils Lab Analyses and submit it to the City Engineering Inspector for approval prior to use.

(d) Notify City Engineering Inspector for observation of application and incorporation of soil amendment as specified in this Section 20-1.04.

(e) Rototill soil amendment mix into the soil to a depth of 8 to 12 inches.

*Note for Option 2: Where soil types vary significantly by location to the extent that soil amendment recommendations will also vary, care must be given by the contractor to properly mark each area to receive the appropriate recommended amendment based on the soil sample location data.

20-1.05 Finish Grading

After the application of soil amendment pursuant to Section 20-1.04, "Soil Preparation and Amendment," all areas to receive landscape planting shall be final graded to the lines and grades shown on the plans. Areas to be seeded shall be evenly graded to present a smooth and even surface free of humps and hollows. Immediately prior to seeding, the surface of the area to be planted shall be sufficiently loose and friable to receive the seed.

The Contractor shall finish grade all areas to receive landscape planting below the surfaces of all adjacent walks, curbs, mow strips, paved areas, etc., to the depth specified below and in all cases without abrupt changes in gradient:

Turf Areas: ½ inch
Tree, Shrub and Ground Cover Areas: 1 inch

20-1.06 Weed Control

After grading operations have been completed pursuant to Section 20-1.05, "Finish Grading," and prior to planting, the Contractor shall notify the Engineer of site conditions. All remaining weeds shall be removed and/or eradicated as determined by a licensed Pest Control Advisor (PCA) in writing. The Contractor shall verify the method of weed control employed whether by fumigation, chemical methods, mechanical methods or others as determined by a licensed PCA in writing. The Contractor shall use and apply weed control materials in accordance with manufacturers' recommendations and all applicable codes and ordinances. The materials shall be applied by a licensed applicator or an employee under the supervision of a licensed applicator.

The Contractor shall consistently use recommended weed control methods throughout the construction period. The Contractor will not allow weeds to become established or persist in any portion of the project. Prior to beginning the 90-day maintenance period and prior to final acceptance, the Contractor shall apply pre-emergent herbicide at the manufacturer's recommended rate on all non-turf areas. If weeds become persistent, the maintenance period will be extended or

suspended by the Engineer. The City may require an application of pre-emergent herbicide to turf areas if it is determined to be necessary. Depending on conditions, the Engineer may order additional applications of pre-emergent herbicide on both turf and non-turf areas.

20-1.07 Plant Material

In all cases, materials shall be furnished as needed to complete the work in quantities designated on the Plans or the Specifications. The Contractor shall provide upon request valid invoices to verify amounts of various materials to be used. All plant material shall conform to the requirements of the Agricultural Code of the State of California, these Specifications, and the Contract Specifications. All plant material shall be grown in nurseries that have been inspected by the State Department of Agriculture and certified to have complied with its regulations.

Plant nomenclature shall be defined by the list of plant materials on the Landscape Planting Plan. All trees, shrubs, and other plants shall be the variety and size shown on the plans, and shall conform to the requirements of these specifications. All trees, shrubs, and other plants shall be tagged with their botanical and common plant name in accordance with recommendations of the American Association of Nurserymen.

Substitutions for the indicated plant material will be permitted, provided the substitute materials are approved in advance by the Engineer, and the substitutions are made at no additional cost. All substitute plant material shall conform to the requirements of these Specifications unless otherwise approved by the Engineer.

All plant material shall be symmetrical, typical for variety and species, sound, healthy, vigorous, free from plant disease, insect pests or their eggs, mechanical injury, excessive abrasions, or other objectionable disfigurements, and shall have healthy, normal root systems, well filling their containers, but not to the point of being root bound. All plant material shall have a habit of growth that is normal to the species, and be sound, healthy, and vigorous. Tree trunks shall be sturdy and well hardened off. Trees and shrubs shall not be pruned prior to delivery except as authorized by the City. In no case shall trees be topped. Root condition of plants will be determined by the City by removing soil from the roots of at least two (2) plants but not more than 2% of the total number of species or variety from each source.

20-1.08 Planting, General

Seeding/Planting shall not commence until all construction work, clearing and grubbing, grading, soil preparation, and weed control are complete. In addition, no planting activities are to proceed until the irrigation system is 100% complete, connected to a permanently installed City water meter and backflow prevention device, is operational, and approved by the Engineer. Exceptions may be granted by the Engineer on a case-by case basis.

Planting of trees and shrubs shall conform to the applicable Standard Drawings for Tree Planting and Shrub Planting, to Section 20-3.04 “Tree Planting Holes and Backfilling; Root Barriers,” for trees, and Section 20-4.02, “Shrub Planting Holes and Backfilling.” Planting holes shall be dug and prepared as required for the individual plant. No plant material shall be planted if the root ball is broken or cracked either before or during the process of planting. Once set, the root ball or trees and shrubs shall be scored to a depth of 1 inch to prevent circling roots.

Plants shall be set so that each plant shall bear the same relation to soil level when planted as it did when in its container. Generally, trees and shrubs should be set with the top of the root ball approximately 1 inch above the finish grade. Each plant shall be placed in the center of the plant pit.

Planting holes (except trees) shall be backfilled around the root ball with the amended soil removed from the hole. Planting holes for trees shall be backfilled with a mix composed of M-Roots or approved equal and soil removed from the hole, using mix ratios recommended by the additive manufacturer. Reference is made to Section 20-3.04, "Tree Planting Holes and Backfilling; Root Barriers."

Backfill material in planting holes shall be tamped firm and a shallow basin as shown on the Standard Drawings formed around the plant to hold enough water to saturate the root ball and backfill. Plants and trees shall be watered immediately after planting.

20-2 Turf

20-2.01 Seeded Turf

Where the Plans or Contract Specifications require the planting of seeded turf, seed to be furnished for the work shall be of top quality and of the variety specified. Seed shall be certified as compliant with requirements of the Agricultural Code of the State of California and the California Seed Law. Certification tags shall be currently dated. Seed varieties shall consist of the following:

Summer application: Futura Heat Bermudagrass or approved equal
Winter application: Mensa Perennial Ryegrass or approved equal

The Contractor shall furnish both varieties of seed to the job site sufficient in quantity to plant all areas to receive turf planting in accordance with these specifications. Unless otherwise specified in the Contract Specifications, the seed variety appropriate for the season shall be planted. The seed not planted shall be furnished at no cost to the City. The following method shall be used to determine the appropriate planting seed variety:

(a) At the time all areas to receive turf planting are considered ready to plant, the Contractor shall measure soil temperatures at representative locations for four consecutive days at a depth of 1 inch.

(b) For soil temperatures at or below 65°F – plant Ryegrass(Typically September 1 through March 31).

(c) For soil temperatures above 65° - plant Bermudagrass (Typically April 1 through August 31). For inconsistent temperature readings, consult the City Parks Division Manager.

(d) The Contractor shall confirm all test results with the City Parks Division Manager prior to proceeding with planting, and shall notify the Engineering Inspector prior to commencing planting operations.

(e) The following spread rates shall be used for planting seed:
Futura Heat Bermudagrass: 100 lbs per acre
Mensa Perennial Ryegrass: 200 lbs per acre

20-2.02 Turf Fertilizer

The Contractor shall furnish and apply commercial fertilizer conforming to the requirements of the California Food and Agriculture Code and these specifications to areas planted with turf seed or sod. The commercial fertilizer shall be homogenous pellet form of a long lasting type of turf fertilizer

consisting of both ammoniac and organic nitrogen, phosphorus, potassium (potash), sulfur, and minor elements of iron, zinc, and manganese.

For areas planted with seed, the Contractor shall provide a minimum of three applications of fertilizer. The first application shall be made at the time of seeding. The second application shall be made 30 days thereafter. The third application shall be made 60 to 90 days following the second application. Fertilizer shall be furnished and applied as follows:

(a) First application: Balanced Starter Fertilizer approved by the Engineer.

(b) Second and third application: Balanced Fertilizer approved by the Engineer spread at a rate that will provide 1 lb. of actual Nitrogen per 1,000 sq. feet of seeded area.

(c) For areas planted with sod, perform only the second and third applications.

20-2.03 Planting Turf Seed

Unless otherwise shown on the Plans or specified in the Contract Specifications, planting of turf seed shall be done by hydroseeding. Hydraulic equipment used for the application of the fertilizer, seed, and slurry of prepared wood mulch shall be of the "Super Hydro-seeded" type. The equipment shall have a built-in agitation system and operating capacity sufficient to agitate, suspend and homogeneously mix a slurry.

For some projects, direct sowing of turf seed may be approved by the City. In these instances, the soil is to be moistened prior to seeding, and the seed shall be distributed in an even, uniform manner. Seed shall be planted using a mechanical drill seeder such as a “Brillion” or a Culti-Pack type device. Broadcast-type equipment may be used only for overseeding in established turf areas.

For both types of planting, seed beds shall be kept continually moist after planting. The time interval between "water off" and "water on" irrigation is to be governed strictly by the amount of surface moisture.

20-2.04 Planting Turf Sod

Where shown on the plans or specified in the Contract Specifications, turf sod shall be furnished and planted in accordance with these specifications. The variety of sod shall be a premium quality Bermudagrass approved by the Engineer.

Sod shall be installed in accordance with the following:

(a) Irrigate areas to receive sod to a depth of 2 inches prior to installation. Sod is not to be planted on dry soil.

(b) Sod must be installed within 8 hours of delivery to the job site. Protect stored or unused sod from damage by heat, sunlight, or any other adverse condition.

(c) Handle sod with care. Torn pieces must have ends cut straight. Pieces smaller than 24 inches in length are to be used only for patching or repairs.

(d) Lay sod evenly in a staggered pattern of strips so that the roll ends are consistently at different locations. Lay and fit sod so that all end joints and cuts are free of voids. Sod shall be placed flush with the finished grade of adjacent walkways, curbs or other hardscape areas.

(e) Tamp each roll into position against adjacent strips to eliminate gaps, openings or uneven joints.

(f) Trim sod to conform to turf area shapes. Expose all sprinklers and valve boxes. Provide a clean straight edge.

(g) Roll all sod areas with a roller of appropriate weight immediately after installation to remove air pockets and provide complete contact between sod and soil.

(h) After installation, irrigate sod completely and at subsequent intervals to provide optimum moisture throughout the period of establishment. Reference is made to Section 20-2.05, "Turf Watering."

20-2.05 Turf Watering

After approval of the turf planting operations by the City Inspector, the Contractor shall continuously irrigate to keep all planted areas moist, but not flooded. The areas shall not be watered to the extent of saturating the soil. After water has once been applied, no portion of the seeded areas shall be allowed to dry out during the entire germination period. The Contractor shall be responsible to alter the watering times and frequencies to meet site conditions. Sod shall be irrigated thoroughly so that moisture penetrates through the sod into the original soil. Use of a penetrating agent is advised.

20-2.06 Turfgrass Establishment Period

The turfgrass establishment period is the time required for all areas of seed-planted turf to reach a healthy and vigorous growing status with no bare, weak, or sparse areas of grass, and able to sustain a minimum of two mowings. For sod-planted turf, the establishment period is the time required for the root system to become firmly attached to the native soil, and the grass maintains a continuous healthy appearance with no changes of color or other indications of water deficiency or disease. The establishment period for seeded or sod turf shall last until the overall maintenance period specified in Section 20-8, "Maintenance Period," commences.

During the establishment period, the first mowing shall not commence until the grass is generally at least 2 inches but less than 4 inches high. For the second mowing and all subsequent mowings, the mower shall be set to cut the grass at a height of 1 ½ inch for Bermuda grass and 2 ½ inches for Ryegrass. After the first mowing, the Contractor shall remove all rocks or other debris that would constitute a hindrance to subsequent mowings.

During and throughout the establishment period, the Contractor shall reseed the spots or areas in which normal germination of the seed is not evident; repair all damage done by his operations; fill all depressions and eroded channels with sufficient top soil to raise to the proper grade, compact lightly and reseed the filled areas; and roll all seeded and reseeded areas. The lawn shall be mowed at least once every seven (7) calendar days, at no time allowing the grass to achieve a height greater than 3". For the duration of the establishment period, turf shall be maintained in a weed free condition. Weeds in turf areas will be removed and/or eradicated as recommended by a licensed Pest Control Advisor (PCA) in writing. The establishment period will not end nor will the maintenance period specified in said Section 20-8 commence until all conditions set forth herein for Turfgrass Establishment Period are satisfied.

20-3 Trees

20-3.01 General

The Contractor shall furnish and plant trees conforming to and in accordance with Section 20-1.07, "Plant Material," the applicable Standard Drawings for Tree Planting, and the Specifications, and in the quantities, varieties, and locations shown on the Plans and specified in the Contract Specifications. Where trees shown on the plans or specified in the Contract Specifications are designated by container size in gallons, the following standards shall apply, unless otherwise approved by the Engineer:

5 Gallon Tree Standard:
Tree diameter shall be at least ½ inch, as measured 6 inches from the container soil level.
Tree height shall be at least 4-1/2 feet, as measured from the container soil level.

15 Gallon Tree Standard
Tree diameter shall be at least ¾ inch, as measured 6 inches from the container soil level.
Tree height shall be at least 6 feet, as measured from the container soil level.

20-3.02 Spacing

Trees shall be planted at the locations shown on the plans or specified in the Contract Specifications except as provided herein. In the absence of dimensioned plans or Contract Specifications, for trees that are to be spaced in rows, the total dimension shall be verified and the trees equally spaced within the designated area. Where trees are shown in an informal pattern, the Contractor shall space the trees as accordingly, maintaining an unequal spacing as shown on the plans and as directed by the Engineer.

In all cases, the Contractor is to ensure that the spacing of trees conforms to the following spacing guidelines. Trees shall be planted no closer than:

(a) 30 feet from street corners measured from curb return ends or stop signs.
(b) 15 feet from alleys.
(c) 15 feet from driveways.
(d) 20 feet from light poles.
(e) 15 feet from power poles.
(f) 10 feet from fire hydrants.
(g) 6 feet from concrete improvements, unless otherwise shown on the plans.
(h) 8 feet from sewer and storm drain lines.
(i) 10 feet from gas and electrical lines.
(j) 10 feet from water lines.
(k) 10 feet from telephone and cable television lines.
(l) 20 feet from other acceptable trees.
(m) 6 feet from adjoining property line.

When tree spacing conflicts with the above guidelines, the Contractor is to recommend alternate locations to be approved by the Engineer.

20-3.03 Drainage Holes

Subsurface soil conditions may require drainage holes for proper tree development as determined by the Engineer. Unless otherwise shown on the Plans or specified in the Contract Specifications, as directed by the Engineer, the Contractor shall drill a representative number of test holes at least 10

feet deep to determine drainage characteristics of the underlying soil at areas to receive tree plantings. Reference is made to Section 8-15, "Utility and Non-Street Facilities; Potholing."

For locations which the Engineer determines the soil to be poorly draining, the contractor shall proceed to drill drainage holes in accordance with the following.

At the locations directed by the Engineer, 12 inch diameter drainage holes shall be drilled for each tree to be planted as designated on the drawings and details. The depth of the drainage hole shall be determined as follows:

(a) The hole must penetrate through and beyond any underlying hardpan or other impervious material or soil stratum. All hardpan or other impervious material shall be removed from the drilled hole.

(b) The hole shall be drilled to a depth where visual evidence of subsurface sand or gravel drainage stratum is apparent.

(c) If there is no apparent drainage stratum, the drainage hole shall be drilled to a minimum of 10 feet deep.

After drilling is completed, non sandy soil or impervious material drilled from the hole shall be replaced with sandy soil. Backfilling shall be performed in 24 inch lifts, with each lift thoroughly saturated with water prior to placing the next lift.

Payment for drainage holes will be made at the contract item bid price therefor. If no contract item is provided for drainage holes, the cost thereof shall be paid for as Extra Work in conformance with Section 4-11, "Extra Work."

20-3.04 Tree Planting Holes And Backfilling, Root Barriers

Tree planting holes shall be dug and prepared in accordance with the applicable Standard Drawings for Tree Planting at the locations shown on the plans to receive trees, or at the locations determined in accordance with Section 20-3.02, "Spacing." Holes shall have level bottoms and a diameter twice that of the root ball. At locations approved by the Engineer, planting holes may be prepared by auguring two 24" diameter holes side by side. In either case, holes shall have a depth no greater than the planned depth of the root ball.

Reference is made to Section 20-1.08, "Planting, General," and Section 20-3.05, "Tree Fertilizer." Planting holes for trees shall be backfilled with a mix composed of M-Roots or approved equal and soil removed from the hole, using mix ratios recommended by the additive manufacturer. Backfill material in planting holes shall be tamped firm and a watering basin conforming to the applicable Standard Drawing for Tree Planting formed around the plant. For trees located in turf areas, a grass-free area 24" in diameter shall be provided around the tree, no watering basin shall be formed, and an Arbor Guard or approved equal trunk protective device shall be installed. Trees shall be watered immediately after planting.

Root barriers shall be installed in conformance with the applicable Standard Drawings for Root Barrier and for Tree Planting.

20-3.04(A) Structural Soil

Where the installation of Structural Soil is shown on the Plans or specified in the Contract Specifications, Structural Soil shall be "Rosenbalm Rockery's Structural Soil" or approved equal.

20-3.05 Tree Fertilizer
During the planting operation, apply Best Packs planting tablets or equal, per the manufacturer's recommendations.

20-3.06 Tree Staking
Stake Coniferous Evergreen trees with one Lodge Pole Pine stake. Stake Deciduous and Broadleaf trees with two Lodge Pole Pine stakes. For all trees planted in park strips adjacent to streets, or in lawn areas adjacent to sidewalks, place stakes parallel to the street or sidewalk. For Conifers planted in other areas, place stake on the prevailing windward side of the tree. For Deciduous and Broadleaf trees in all other areas, place stakes perpendicular to the prevailing wind direction. Each stake shall be vertical, 12 to 18 inches from the trunk of the tree, and at least 12 inches into native soil below bottom of tree planting hole. Stakes shall not be driven into the root ball. Stake tops shall be below crown of the tree.

20-3.07 Mulching
Where mulching of tree watering basins is shown on the Plans or specified in the Contract Specifications, "Walk-on-Bark" mulch shall be applied as top dressing in accordance with the Standard Drawing for Tree Planting. Trunks of trees shall not be engulfed with mulch.

For trees located in turf areas, a 24 inch diameter grass free area shall be provided around each tree. Mulch shall be omitted for these locations.

20-3.08 Tree Establishment Period
The Tree Establishment Period is the time required for newly planted trees to exhibit an initial healthy and robust appearance, absent of wilting or other signs of stress as determined by the Engineer. The Tree Establishment Period shall commence immediately upon planting and shall continue until the commencement of the maintenance period specified in Section 20-8, "Maintenance Period." The maintenance period will not be permitted to commence until all trees have met the requirements of the tree establishment period. During the tree establishment period as well as the maintenance period, all watering basins around trees shall be maintained at a depth of 3 inches. Watering shall occur at intervals adequate to promote healthy root and plant growth. Trees are to be maintained in their natural shapes. Branches shall be thinned out where necessary. In no case shall trees be pruned by heading or topping. Any plants severely pruned in this manner shall be removed and replaced at Contractor's expense. Tree stakes or ties that for any reason are damaged or rendered inadequate for support during this period shall be replaced to their original condition.

20-4 Shrubs

20-4.01 Spacing
The Contractor shall furnish and plant shrubs conforming to and in accordance with Section 20-1.07, "Plant Material," the applicable Standard Drawing for Shrub Planting, these Standard Specifications, and in the quantities, varieties, and locations shown on the Plans and specified in the Contract Specifications. When shrubs are to be planted in rows, the total dimension shall be verified and the plants equally spaced within the designated area. Where shrubs are shown in an informal pattern, the Contractor shall space the material appropriately and as directed by the Engineer. A minimum 3' clearance shall be maintained between shrubs and hardscape features such as sidewalks, curbs, fences, or any such fixture.

20-4.02 Shrub Planting Holes And Backfilling
Shrub planting holes shall be dug and prepared in accordance with the Standard Drawing for Shrub Planting at the locations shown on the Plans to receive shrubs, or at the locations determined in

accordance with Section 20-4.01, “Spacing.” Holes shall have level bottoms, a diameter twice that of the root ball, and a depth equal to the planned bottom of the root ball.

Planting holes for shrubs shall be backfilled in accordance with Section 20-1.08, “Planting, General,” and Section 20-4.03, “Shrub Fertilizer,” with the amended soil removed from the planting hole. Backfill material in planting holes shall be tamped firm and a watering basin conforming to the Standard Drawing for Shrub Planting formed around the plant. Shrubs shall be watered immediately after planting.

20-4.03 Shrub Fertilizer
During the planting operation, apply Best Packs or approved equal planting tablets per the manufacturer’s recommendations.

20-4.04 Mulching
Where mulching of shrub watering basins is shown on the plans or specified in the Contract Specifications, "Walk-on-Bark" mulch shall be applied as top dressing in accordance with the Standard Drawing for Shrub Planting. Shrub stems shall not be engulfed with mulch.

20-4.05 Shrub Establishment Period
The Shrub Establishment Period is the time required for newly planted shrubs to exhibit an initial healthy and robust appearance, absent of wilting or other signs of stress as determined by the Engineer. The Shrub Establishment Period shall commence immediately upon planting and shall continue until the commencement of the maintenance period specified in Section 20-8, “Maintenance Period.” The maintenance period will not be permitted to commence until all shrubs have met the requirements of the shrub establishment period. During the shrub establishment period as well as the maintenance period referenced in Section 20-8, “Maintenance Period,” all basins around shrubs shall be maintained at a depth of 3 inches. Watering shall occur at intervals adequate to promote healthy root and plant growth. Shrubs shall be maintained in their natural shapes. Overlong or scraggly branches shall be pruned where necessary.

20-5 Ground Cover

20-5.01 Spacing
Where Ground Cover plant material is shown on the plans to be planted in an informal pattern, material shall be planted in a random pattern and not in straight rows. The Contractor shall space the material as determined by the Engineer or spaced as specified in the ground cover list on Landscape Planting Plan where such plan is included.

20-5.02 Ground Cover Areas
For areas shown on the plans to receive Ground Cover, the material shall be planted sufficiently deep to cover all roots. At the time of planting all ground cover plants, the earth around each plant shall be firmed sufficiently to force out all air pockets. Alternate procedures in the planting of ground covers shall be approved by the Engineer, but shall not release the Contractor from the noted guarantee described herein.

20-5.03 Mulching
Where shown on the plans or specified in the Contract Specifications, mulch shall be applied as top dressing all ground cover watering basins with bark to a depth of 2 inches. Mulch shall be "Walk-on-Bark."

20-5.04 Ground Cover Fertilizer

Ground Cover shall be fertilized as needed or as directed by the Engineer during the establishment and maintenance period.

20-5.05 Ground Cover Establishment Period

The Ground Cover Establishment Period is the time required for newly planted groundcover to exhibit an initial healthy and robust appearance, absent of wilting or other signs of stress as determined by the Engineer. The Ground Cover Establishment Period shall commence immediately upon planting and shall continue until the commencement of the maintenance period specified in Section 20-8, "Maintenance Period." The maintenance period will not be permitted to commence until all ground cover has met the requirements of the Ground Cover Establishment Period. During the ground cover establishment period as well as the maintenance period referenced in said Section 20-8, all basins around the ground cover plants shall be maintained at a depth of 3 inches. Watering shall occur at intervals adequate to promote healthy root and plant growth.

20-6 Tree Transplanting

20-6.01 General

Where transplanting of trees is shown on the Plans or specified in the Contract Specifications, all work shall comply with these Standard Specifications.

20-6.02 Planting Site Preparation

20-6.02(A) Drainage Hole

One (1) drainage hole, minimum diameter of 12 inches, shall be drilled for each tree to be transplanted as designated on the plans. Reference is made to Section 8-15, "Utility and Non-Street Facilities; Potholing." The Contractor will be responsible for locating all underground utilities. The depth of the drainage hole shall be determined as follows:

(a) The hole must penetrate through and beyond the underlying paving material or hardpan soil stratum. All paving material or hardpan shall be removed from the drilled hole.

(b) The hole shall be drilled to a depth where visual evidence of the subsurface sand or gravel drainage stratum is apparent.

(c) If no sand or gravel drainage stratum is apparent, the drainage hole shall be drilled to a minimum of 10 feet deep.

After drilling, the drainage hole shall be backfilled with sandy soil placed in 2 foot lifts. Each lift shall be thoroughly watered. Repeat the process until the drainage hole is completely backfilled.

20-6.02(B) Tree Transplanting Hole

The transplanting hole shall be excavated to the depth of the bottom of the anticipated spaded root ball, and to a diameter so as to create a planting hole extending 3 feet on all sides beyond the spaded rootball.

Excavated material removed from the hole shall be set aside for later backfill. If different layers of soil exist, each stratum shall be kept separate for replacement at the same level during backfill. Any loose hardpan shall be removed from material excavated from the hole.

20-6.03 Tree Preparation

20-6.03(A) Root Pruning

Prune all roots to a depth of 2 feet. Pruning location shall be 6 inches inside the tree spade circumference. Pruning shall be performed at least sixty (60) days prior to the anticipated spading date, or as directed by the Engineer. The rootball soil shall be kept moderately moist during this period. All pruning cuts shall be clean cut. Any torn root endings shall be trimmed back to create clean cuts.

20-6.03(B) Branch Pruning

Pruning objectives shall be to reduce foliage 10 to 25%, to remove crossing branches, and to remove branches that will interfere with future branch spacing. All cuts shall be performed in accordance with "ANSI" Pruning Standards, (ANSI A300, Part 1). All cuts shall be clean with no ragged edges and shall be made just outside the branch collar. Tree wound dressing shall not be applied to the newly exposed wood. Trimming shall be to a branch no smaller than one-half the size of the branch being removed. Limbs with diameter larger than one-quarter the diameter of the trunk, or branches larger than 6 inches shall not be removed unless said removal has been determined by the Engineer to be necessary to provide tree spade access.

Limbs shall be tied from the top down as required to prevent injury during handling and transport.

20-6.03(C) Rootball

The Contractor shall spade the rootball on the day of transplanting. The treespade shall be centered around the tree. Cuts made by the spade shall be clean; spades shall close at the base of the rootball. Twisting shall be avoided during the removal of the rootball. Any torn roots shall be trimmed to create a clean cut. The rootball shall be protected from drying during holding and transport to the new site. Protection shall be provided by clear plastic wrapping shielded from the sun, or by covering with regularly weted burlap. Provision shall be made to dampen the rootball should holding conditions threaten to allow it to dry out.

20-6.04 Tree Transplanting

The transplanted tree shall be placed in the tree transplanting hole at a level duplicating its original soil depth. Backfill material consisting of native material originally removed from the transplanting hole shall be tamped in on all sides of the rootball. Care shall be exercised by the Contractor in replacing stratified layers of backfill as they existed before removal from the hole. Backfill shall be placed in layers not to exceed 2 feet, with each layer watered thoroughly prior to placement of the next layer. “Best Paks” or approved equal plant tabs shall be placed every 2' along the circumference of the rootball, 6 inches below the finished soil line. Immediately after the tree has been transplanted, a 4 inch deep circular watering basin shall be constructed around the base of the tree, extending 24 inches outside the rootball circumference. The watering basin shall be filled with water immediately and repeatedly, and backfill probed with a pole to remove all air pockets. Additional native soil shall be added as necessary to maintain ground level during the settling period.

Evergreen trees, or deciduous trees in leaf, shall be sprayed with an anti-desiccant as directed and approved by the Engineer.

20-6.05 Staking And Guying

Transplanted trees shall be staked and guyed from three different equidistant points, one of which should be in line with and providing support against the prevailing wind. Appropriate straps shall be provided to protect the tree from direct contact with the wire or cable, using rubber hose or flexible plastic tubing.

Smaller trees (30 to 50 inches diameter rootball) shall be anchored with wooden stakes and ties strong enough to support the tree.

Larger trees (greater than 50 inch rootball) shall be anchored with 1/8 inch or 3/16 inch cable and earth anchors.

Tie white surveyor's tape at breast height to each cable to provide cable visibility.

20-6.06 Mulching
Where mulching of tree wells is shown on the plans or specified in the Contract Specifications, place "Walk-on-bark" mulch approved by the City to a depth of 3 inches to cover the soil surface at a diameter 24 inches wider than the drip line of the tree, but not touching the trunk of the tree, in order to improve water retention in the soil and to moderate soil temperatures in the summer.

20-6.07 Responsibility
The Contractor shall at all times exercise due diligence in performing all aspects of tree transplanting, follow all recommendations of the Engineering Inspector and City Parks Personnel, adhere to these specifications and to good horticultural practices relating to transplanting trees, and provide proper maintenance and watering until acceptance of the transplanted trees by the Engineer. Should a transplanted tree fail to survive, and the Engineer determines that the failure is due to the Contractor's negligence in carrying out the foregoing operations, the Contractor shall forfeit an amount per failed tree specified in the Contract Specifications as a liquidated damage.

20-6.08 Measurement And Payment
All costs for transplanting trees in conformance with these specifications, including tree preparation, plant site preparation, transportation, fertilizing, watering, and all other incidental costs related thereto, shall be included the unit or lump sum price bid for transplanting trees. In the absence of a bid item, the cost thereof shall be included in the lump sum bid for Landscaping in accordance with Section 20-10, "Measurement and Payment."

20-7 Cleanup
After all planting operations are completed, the Contractor shall remove all trash, excess soil, empty plant containers, or other accumulated debris, from the site at no extra cost to the City. Contractor shall repair all scars, ruts or mars in the area caused by work operations. Areas shall be left in a neat and orderly condition. The cost for cleanup shall be included in the various contract items, and no additional payment made therefor.

20-8 Maintenance Period
Unless otherwise provided in the Contract Specifications, a ninety (90) calendar day maintenance period will be required for all landscape planting as specified herein. The maintenance period will not be commenced until all work, regardless of nature, called for in the Plans, Contract Specifications, and these specifications for Landscape Planting is completed, inspected, and approved by the Engineer, unless otherwise authorized by the Engineer. A written notice to commence the maintenance period will be issued to the Contractor by the Engineer.

Maintenance period work includes, at a minimum on a weekly basis, all litter pickup and removal, watering, mowing, edging, weeding, plant replacement, mulching, cultivating, pest and disease control, and trimming necessary to bring the planted areas to a healthy growing condition and any additional work, including emptying of trash receptacles, needed to keep the work site neat and attractive.

Prior to the final inspection at the conclusion of the maintenance period, the Contractor shall apply a pre-emergent herbicide at the recommended rate.

During the maintenance period, any plant indicating weakness or probability of dying shall be replaced at the Contractor's expense. Constant diligence shall be maintained to prevent disease, insects, and/or rodent infestations and proper preventative or control measures shall be taken. All areas included in the work shall be substantially clean and free of debris and weeds. All plant materials shall be live, healthy and free of infestations.

Any erosion or settling of soil caused by watering shall be repaired at the Contractor's expense.

All walks, curbs and gutters shall be kept clear of debris, mud, dust and standing water by sweeping, mopping or hosing down as required for complete cleanliness.

The maintenance period may be terminated or suspended by the Engineer should it be determined that the Contractor fails to adequately water, replace unsuitable plants, control weeds or perform other work necessary for the proper establishment of all new landscaping. If terminated by the Engineer, a new 90 calendar day maintenance period will commence once the Engineer determines that the Contractor has corrected all deficiencies. If suspended by the Engineer, the 90 calendar day maintenance period shall be temporarily interrupted, and will be resumed by the Engineer when it is determined the Contractor has corrected all deficiencies.

Unless otherwise specified in the Contract Specifications, the 90 calendar day maintenance period is incorporated in the overall contract time. Reference is made to Section 8-9, "Liquidated Damages." Should failure to complete all the work required by the Contract lead to a delay in commencing the maintenance period, or should the maintenance period be terminated or suspended, any of which causes the work including the maintenance period to go beyond the contract time allowed, the provisions of said Section 8-9 shall apply.

20-9 Guarantee

In compliance with Section 6-10, "Guarantee of Materials," and Section 7-23, "Guarantee," all plant and turf areas shall be guaranteed as to growth and health for a period of one (1) year after acceptance of the contract by the City Council. Any areas that are not healthy and growing shall be replaced at no additional cost to the City.

The Contractor, within seven (7) days of written notification by the Engineer, shall remove and replace any plant material that for any reason fails to meet the requirements of these specifications. Replacement shall be made with plant material as indicated or specified for the first planting, and all such replacement material shall be guaranteed as specified for the original guaranteed material.

20-10 Measurement And Payment

Except as otherwise provided in this Section 20 for specified work, or as may be specified in the Contract Specifications, the cost of providing all labor, equipment, materials including all seed, sod, trees, shrubs, groundcover, any other specified plant material, amendment, fertilizer, or other incidentals, to provide all work as required for preparation, planting, watering, or any other work required by these specifications, and to provide a complete and healthy growing landscaping all as shown on the Plans, as specified in the Contract Specifications and these Standard Specifications, shall be included in the lump sum price paid for Landscaping. Said price shall also include the cost of all establishment periods, the 90 calendar day maintenance period, and 1-year guarantee. No separate or additional payment will be made.

Structural soil will be measured and paid for as specified in the Contract Specifications. Where no bid item is provided for Structural Soil, the cost thereof shall be included in the lump sum price paid for Landscape Planting, and no separate payment will be made therefor.

SECTION 21 - LANDSCAPE IRRIGATION SYSTEMS

21-1 General

The work shall consist of furnishing and installing landscape irrigation systems, complete and fully functional, all as shown on the Plans, Standard Drawings, as specified in the Specifications, and as directed by the Engineer. The work shall include furnishing all labor, materials, equipment, and supplies necessary for the installation of irrigation pipelines of varying sizes, all forms of sprinklers or other water delivery and control devices and systems, backflow prevention devices, booster pumps, protective cages, electrical service panels and all related wiring, controllers, valves, valve boxes, water service connections, water meter boxes, water consumed in system testing, and security lighting systems related to irrigation improvements where required. The contractor shall comply with the latest edition of the "Rules and Regulation governing the Distribution and Use of Recycled Water".

In compliance with Section 2-2, "Examination of Site of Work, Plans, Specifications and Contract Documents," the Contractor shall examine carefully the site of work. Submission of a bid shall mean that the Contractor has investigated and is satisfied as to the conditions to be encountered, the character, quality, and quantity of work to be performed and materials to be furnished, and the requirements of the Plans, the Contract Specifications, and these Standard Specifications.

All work called for on the Plans, the Standard Drawings, or set forth in the Specifications shall be executed in accordance with all governing ordinances, laws, codes and regulations including, but not limited to, the current edition of the California Plumbing Code and the California Electrical Code, and shall meet all local conditions. Any changes and/or additions in work necessary to comply with ordinances, laws, codes and regulations and/or conditions will be made without additional expense to the City, but such changes shall have the prior written approval of the Engineer.

21-2 Design

The objective of the Plans and Specifications (design) is to provide an assembled and installed landscape irrigation system which will operate in an efficient and satisfactory manner. The finished system shall adequately and efficiently irrigate all areas to be covered and shall perform in all respects in conformance with the plans and specifications and to the satisfaction of the City.

Due to the scale of the drawings, it is not always possible to indicate all offsets, pipe or conduit fittings, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting the work, and plan the work accordingly, furnishing such fittings, couplings, pipes, conduits, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and professional manner, so that conflicts between irrigation systems, lighting systems, planting, and architectural features will be avoided. The Contractor shall verify the correctness of all finish grades within the work area in order to ensure the proper soil coverage as specified for the irrigation system pipes.

The Contractor shall not willfully install the irrigation facilities as indicated on the Plans when it is obvious in the field that obstructions or grade differences exist that might not have been considered in the design. Such obstructions or differences should be brought to the attention of the Engineer, in writing, by the Contractor for consideration of adjustment in proposed facility locations, prior to installation of facilities.

The Contractor shall verify and be familiar with the location and size of the existing water supply and shall make connections in accordance with the Plans, Standard Drawings, and the Specifications. The water meter required for the project will be provided at no cost by the City Public Utilities

Department. The Contractor shall furnish the meter box, all fittings, valves, pipeline, and all appurtenances required for a complete water service. The Contractor shall comply with the provisions in Section 5-13, "Electrical and Water Service," and Section 17, "Water Use." Unless otherwise specified in the Contract Specifications, the Contractor will be charged for all water consumed in the installation of landscape irrigation systems, including testing of irrigation systems.

Unless otherwise noted on the Plans or Contract Specifications, the irrigation system has been designed in such a manner so that:

(a) All irrigation will occur between the hours of 10:00 p.m. and 6:00 a.m.;
(b) Each individual valve station is capable of operating effectively at line pressure;
(c) Booster pumps have been added only to allow the operation of multiple valve stations concurrently.

The Contractor shall not vary the installation of the irrigation system from these design parameters without the express approval of the Engineer.

21-3 Permits

Prior to beginning any work, the Contractor shall obtain a City of Clovis Encroachment Permit from the City Engineering Division, an Electrical Permit and a Plumbing Permit from the City Building Division, and pay all fees associated therewith, all in compliance with Section 7-10, "Permits and Licenses."

21-4 Specialized Inspection

All of the work described herein will be subject to inspections by an Engineering Division inspector and specialized City Parks Division personnel, as ordered by the Engineer. Additional inspections will be conducted by the City Building Inspection Division for work covered by the California Electrical and Plumbing Codes. Reference is made to Section 21-11, "Inspection." Specialized inspections will be made of items including the following:

(a) Grading.
(b) Alternative materials where allowed.
(c) Locations of above and below-ground facilities if different from the plans.
(d) Performance inspection prior to planting.
(e) Pre-final performance inspection prior to beginning plant maintenance period.
(f) Performance inspection during plant maintenance period.
(g) Final inspection after completion of the plant maintenance period.

All overtime inspection charges incurred by specialized City Parks Division personnel shall be paid by the Contractor when inspection services are required outside of normal working hours. Work requiring inspection before or after the normal 8 hours of a normal working day or taking place on holidays Saturdays and Sundays will be considered overtime inspection. The Contractor will be billed at the standard City hourly overtime rate. Failure to pay the bill will be cause to deduct the amount from monies due the Contractor.

A pre-final inspection of the work shall be made by the City Engineering Inspector and Parks Division personnel in the presence of the Contractor, at the time when all landscaping and irrigation work is completed and inspection is requested by the Contractor to commence the plant maintenance period. In compliance with Section 20-8, "Maintenance Period," and Section 21-12, "Maintenance Period," the Contractor shall make the inspection request to the Engineer two working days prior to the requested time of such inspection. After the system has been completed in all respects, the

Contractor shall instruct an authorized representative of the City Parks Division in the operation and maintenance of the system and shall furnish a complete set of written operating instructions.

At the time of the pre-final inspection, the Contractor shall have prepared and transmit to the City Engineering Inspector a set of record or "as-built" drawings of the landscaping and irrigation work.

At the conclusion of the maintenance period, a final inspection shall be scheduled by the Contractor two working days in advance of the requested inspection.

In the event the Contractor schedules an inspection and has not completed the work that is to be inspected or made an effort to do so, the Contractor will be billed at the standard City hourly rate for the cost of time expended by City inspectors in preparing for and making the determination that the work has not been satisfactorily completed to warrant an inspection. If the inspection was scheduled to occur on overtime, a weekend, or holiday, said charge will be calculated at the standard City overtime/double time rate as applicable. Failure to pay the bill will be cause to deduct the amount from monies due the Contractor.

21-5 Materials

In accordance with Section 6, "Control Of Materials," any material specified by name and/or model number in the Plans, Standard Drawings, Contract Specifications, or these Standard Specifications shall be deemed to be used for the purpose of identifying the standard of quality and type of materials and insuring the specific use of that material in the construction of the system. If substitution of a material is desired by the Contractor, sufficient descriptive literature and material samples must be furnished to establish the material as an equal substitute. In addition, the Contractor must state his reasons for desiring substitute materials.

Material used in landscape irrigation systems shall conform to the following requirements:

All recycled water irrigation facilities shall be purple products. Contractor shall comply with the latest edition of the "Rules and Regulation governing the Distribution and Use of Recycled Water" including signage at all common areas where recycled water is used that is accessible to the public.

1. Mainline Irrigation Pipe: All mainline or pressure supply line plastic pipe shall be standard weight class 315 polyvinyl chloride (PVC) 1120 high impact solvent weld pipe. Pipe 2 inches in diameter or less shall be Schedule 40 PVC, solvent weld. The Contractor shall provide adequate thrust-blocks at all changes in direction of the mainline pipe.

2. Lateral-line Irrigation Pipe: All lateral-line or non-pressure line plastic pipe shall be standard weight class 200 polyvinyl chloride (PVC) 1120 normal impact.

   All plastic pipe shall conform to current National Sanitation Foundation (NSF), Iron Pipe Size (IPS) standards and American Society for Testing & Materials (ASTM) requirements. Pipe shall be of improved white rigid PVC compound as manufactured by Lasco Industries or approved equal.

3. Pipe Identification: All pipe shall be continuously and permanently marked with the following information:

   (a) Manufacturer's name or trademark;
   (b) Nominal pipe size;
   (c) Schedule and type of pipe;

(d) Pressure rating in PSI; and
(e) NSF seal of approval.

4. Plastic Pipe Fittings and Connections: All plastic fittings shall be white rigid PVC combination Type I and II, grade I standard weight schedule 40 and/or have a working pressure rating no lower than that of the pipe. The sockets must conform to the outside diameter of the pipe as recommended by the pipe manufacturer.

   All plastic fittings and connectors shall be injection molded of an improved PVC compound featuring high tensile strength, high chemical resistance and high impact strength in terms of current ASTM standards for such fittings and as manufactured by Lasco Industries or approved equal. Where threads are required in plastic fittings, these shall be injection molded also.

5. Fittings Identification: All fittings shall bear the manufacturer's name or trademark, material designation, size applicable (IPS) schedule, and (NSF) seal of approval.

6. Plastic-to-steel Connections: At all PVC pipe to steel pipe connections, the Contractor shall complete the steel connection first. Teflon tape shall be used on all threaded PVC to steel pipe joints applied to the male threads only, and light wrench pressure is to be applied. A minimum of three (3) wraps of Teflon tape shall be used.

7. Plastic Pipe Cement: Solvent cement joints for plastic pipe and fittings shall be made as prescribed by the manufacturer. The high chemical resistance of the pipe and fitting compounds specified in the foregoing sections makes it mandatory that an aggressive colored primer, which is a true solvent for PVC, be used in conjunction with a solvent cement designed for the fit of pipe and fittings of each size range specified.

8. Galvanized Pipe: Pipe shall be hot dip galvanized continuous welded, seamless, schedule 40 steel pipe conforming to applicable current (ASTM) standards.

9. Galvanized Fittings: All fittings shall be galvanized malleable iron ground joint Schedule 40 conforming to applicable current ASTM standards.

10. Sprinkler Heads: Sprinkler spray heads shall be Rain Bird 1800 or Hunter Pro Spray.

11. Spray nozzles:
    (a) nozzles for shrubs shall be Rain Bird MPR;
    (b) nozzles for turf shall be Buckner Brass, or approved equal.
    (c) Walla Walla MP Rotator for shrub or turf.

12. Rotors shall be: Hunter I- Series Stainless Steel; or Rain Bird 5500-Series Stainless Steel; or Rain Bird 7005-Series Stainless Steel.

13. Drip Emitters: Drip emitters shall be of the type and performance as listed on the Plans.

14. Drip Filters: Filters shall be capable of efficiently removing foreign particles that would clog emitters. Filter shall be a flushable type and contain a replaceable stainless steel element. Filters shall contain a 200 mesh screen or as prescribed by the emitter manufacturer. The filter shall be of the type and performance as listed on the Plans.

15. Remote Control Valves: Electric remote control valves shall be Irritrol Series 100 or 102.

16. Valve Boxes: Valve boxes shall Christy Fibrelyte or approved equal. Standard size shall be 11¼ inches x 17 inches.

17. Control Wiring: Connections between the controller and remote control valves shall be continuous, made with direct burial wire AWG-UF Type, single conductor, installed in accordance with valve manufacturer's wire chart and specifications. Valve "hot" wire to be no smaller than AWG No. 14. Valve "common" wire to be no smaller than AWG No. 12.

    Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of no more than 10 feet.

    All splices shall be made using 3M-DBY waterproof sealing packets or approved equal. An expansion loop of 20 inches minimum shall be provided at each wire connection and/or directional turn, unless otherwise specified.

    Wiring shall occupy the same trench and shall be installed along the same route as, and underneath, the pressure supply lines whenever possible.

    All wire splices in field runs shall be located in valve boxes, and indicated on the "as-built" plans.

    Control wires shall be identified at the controller. A separate common wire shall be installed for each controller.

18. Automatic Controller (Electrical and Solar): Controllers shall be fully automatic in operation, and shall be of the type and performance as specified on the Plans or in the Contract Specifications. Each controller shall have the capacity to operate the number of valve stations indicated on the Plans. Controllers shall be certified by Underwriters' Laboratories and bear their stamp of approval.

    Controllers shall be programmable for the various operations as indicated on the Plans or as specified in the Contract Specifications, including programmable master valve and pump on/off functions when such equipment is specified.

19. Gate Valves: Gate valves shall be of the type and performance as specified on the Plans.

20. Backflow Prevention Unit: The backflow prevention unit shall be a reduced pressure principle device. The backflow prevention unit shall also be approved by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research. The backflow prevention unit shall be installed downstream to water meters, in a location approved by the Engineer. The concrete pad therefor shall be Class 2, 3-1/2 in. thick.

21. After being installed at the project site, the backflow prevention unit must be tested and approved as functioning properly by an approved AWWA certified tester within 5 days of installation with the results sent to the City of Clovis Utilities Division. Approval of the backflow prevention unit must precede any shrub, tree, or turf planting. Plumbing from the water meter to the backflow preventer shall consist of galvanized pipe and fittings.

22. Pressure Regulating and Pressure Sustaining Valve: The pressure regulating and pressure sustaining valve shall be of the type and performance as specified on the Plans.

23. Booster Pump: Pump shall be Flow Tronics or Water Tronics, and provide high efficiency, reliability and stable operating pressures. Pump submittals are required and shall be approved by the Engineer, in writing.

    The pump unit shall be pre-fabricated and self-contained, with the following features:

    (a) Variable frequency drive
    (b) High and low pressure system shutdown.
    (c) Motor overload shutdown.
    (d) Full flow bypass.
    (e) Weather-resistant rust-proof enclosure, either powder coated or stainless steel.
    (f) Exhaust fan.

    The concrete pump pad shall Class 2, min. 3-1/2 in. thick, and surround the entire mechanical package (all piping and appurtenances) by a minimum of 12 inches in both length and width.

24. Operations and Maintenance Manuals: Within ten calendar days prior to completion of the construction, the Contractor shall prepare and deliver to the City all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two individually bound sets of Operating and Maintenance Manuals. These manuals shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Spare part(s) lists and related manufacturer identification shall be included for each installed equipment item. Each complete, bound manual shall also contain the following information:

    (a) Index sheet, stating Contractor's address and telephone number, duration of guarantee period, and list of equipment, with names and addresses of local manufacturer representatives.
    (b) Complete operating and maintenance instructions on all major equipment.

25. The Contractor shall be responsible for correct procedures in loading, unloading, stacking, transporting, and handling all materials to be used in the system. The Contractor shall avoid rough handling which could affect the useful life of equipment. Pipe shall be handled in accordance with the manufacturer's recommendations on loading, unloading and storage.

26. Water Meter: Prior to beginning of planting, the Contractor shall contact the City Utilities Division and request the installation of the water meter.

21-6 Trenching And Excavation

Trenching and Excavation shall conform to the requirements of Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration," be open vertical construction, and sufficiently wide to provide free working space around the work installed and to provide ample space for backfilling and tamping.

The use of a vibratory plow or methods other than open vertical trenching will not be allowed without the written approval of the Engineer. To obtain such approval, a field test must be performed, at the proposed site, with the equipment to be used in the presence of the Engineer. The field test is to indicate if the proposed site is favorable to the plowing method. Approval for plowing at one location

does not allow the use of plowing at another location. Approval for plowing must be obtained for each location where the use of plowing is proposed. If, at previously approved plowing locations, conditions for plowing become unfavorable as determined by the Engineer, plowing shall be terminated.

Trenches for pipe and equipment shall be cut to required grade lines, and compacted to provide an accurate grade and uniform bearing for the full length of the pipe. When two pipes are to be placed in the same trench, a minimum 4 inch space between pipes must be maintained.

The depth of the trenches shall be sufficient to provide a minimum cover above the top of the pipe as follows:

(a) 24 inches minimum over main lines;
(b) 18 inches minimum over non-pressure (rotary pop-up) lateral lines;
(c) 12 inches minimum over non-pressure (pop-up spray head) lateral lines;
(d) 24 inches minimum over lines located in paved areas.

21-7 Installation

Installation of all irrigation facilities shall comply with the applicable Standard Drawings and the following specifications.

1. Water Supply: The Contractor shall connect to the water supply line at the location and as indicated on the Plans. Minor changes in location caused by actual site conditions may be required, and shall be approved by the Engineer. The actual location shall be shown by the Contractor on the "as-built" drawings to be furnished to the City upon completion of the work. The Contractor shall comply with the provisions in Section 5-13, "Electrical and Water Service," Section 17, "Water Use," and Section 21-13, "Completion."

2. Layout: The Contractor shall be responsible for layout of proposed facilities at the site and any minor adjustments required due to differences between the site and drawings. Any such deviations in layout shall be within the intent of the original drawings and shall be approved by the Engineer. The City will indicate the proposed precise location of the control panels.

3. Grades: Before starting work on the system, the Contractor shall carefully check all grades to ensure the work may safely proceed and keep within the specified material depths. If the slope of the landscaped area exceeds 10:1, inline check valves shall be installed at each sprinkler subject to low head drainage.

4. Standard of Installation: Material and workmanship shall be in accordance with local codes and ordinances of legally constituted authorities; except where provisions of these specifications exceed such requirements, these specifications shall govern.

5. General Installation: Any equipment installed by the Contractor and deemed to be for the use of the City in various situations (i.e., control valves, control panels, etc.) shall be so installed to be readily accessible and quickly operable. Two keys for lockable equipment shall be supplied to the City upon installation. Equipment deemed by the City to be inoperable for its intended purpose shall be reinstalled by the Contractor in an operable position before approval will be given. Routing of pressure supply lines as indicated on the drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform to details on plans.

6. Assemblies: Install all assemblies specified herein according to the respective detail drawings or specifications pertaining to specific items required to complete the work. Perform work according to best standard practice, with prior approval.

   All plastic and galvanized steel threaded pipe and fittings shall be assembled using Teflon tape applied to the male threads only. A minimum of three (3) wraps of Teflon tape will be required.

7. Pipe Clearance: All pipes shall have a minimum clearance of 4 inches from each other and 6 inches from pipes of other trades. Parallel pipes shall not be installed directly over one another.

8. Plastic to Steel Connections: At all PVC-to-steel pipe connections, the Contractor shall complete the steel connections first. Connections shall always be plastic into steel, never steel into plastic. Teflon tape shall be used on all threaded PVC to steel pipe joints, applied to male threads only, and light wrench pressure is to be applied.

9. Pipe and Fittings, Galvanized Steel Pipe: All pipe shall be reamed and rough edges or burrs removed so that a smooth and unobstructed flow can be obtained.

   Teflon tape shall be carefully and smoothly placed on the male threads only. All threaded joints must be tightened with wrenches. No caulking or joint compound of any kind will be permitted.

   Immediately upon installation of lines, all openings shall be capped or plugged to prevent the entrance of materials that would obstruct the pipe. Caps shall remain in place until removal is necessary for completion of installation.

   Thrust blocks shall be installed as recommended by the pipe manufacturer, or as shown on the detail drawings.

   All mainline and lateral PVC pipe traversing paved concrete or hardscape areas is to be installed in galvanized iron pipe sleeves that are at least 2 inches in diameter larger than the pipe within the sleeve. Galvanized iron pipe for electrical wires traversing such areas shall allow a generous amount of room for the wires present or to be installed and for pulling additional wire in the future.

10. Joining of Pipe: It is the responsibility of the Contractor to be familiar with any and all methods of assembling, joining, and installation of the various types of pipe to be used. The Contractor shall strictly adhere to recommendations in the manufacturer's guide. If during any phase of the work, the Contractor or any of the workers are not familiar with the recommended procedures, the Contractor shall arrange with the manufacturer of the particular product for the services of a qualified manufacturer's representative to instruct the workers in the proper recommended procedures.

11. Plastic Pipe: The Contractor shall exercise care in handling, loading, unloading, and storing plastic pipe and fittings. All plastic pipe and fittings shall be stored under a weatherproof roofed structure before using and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lie flat so as to avoid undue bending or concentrated external load at any point.

All lumber, rubbish, and rocks shall be removed from the trenches by the Contractor. Pipe shall have a firm uniform bearing for the entire length of each pipe line to prevent uneven settlement. Wedging or blocking under riser tees shall be done only if specified on the plans. Pad trenches with soil as necessary to provide uniform bearing surfaces.

Where extensive lengths of pipe are installed, snake pipe in trench from side to side to allow for expansion and contraction. 1 foot per 100 feet (1:100) of pipe is the minimum allowance for snaking. Pipe shall not be placed when there is water in the trench or when the temperature is 32°F or below.

All changes in the direction of the pipe shall be made with fittings, not by bending.

Make solvent joints in the following sequence:

(a) Make sure pipe is cut square and all connecting surfaces are properly cleaned and dry.
(b) Apply an even coat of colored primer to pipe and fitting prior to application of solvent.
(c) Apply an even coat of solvent to the inside of the fitting.
(d) Apply a liberal, even coat of solvent to the outside of the pipe, making sure that the coat area is equal to the depth of the fitting socket.
(e) Insert the pipe quickly into the fitting and turn the pipe approximately one-quarter turn to distribute the solvent and remove air bubbles. Hold the joint for approximately fifteen seconds so the fittings do not push off the pipe.
(f) Using a clean rag, wipe off all excess solvent to prevent weakening at the joint.
(g) exercise care in going to the next joint so that the pipe is not twisted, thereby disturbing the last completed joint.
(h) Allow at least fifteen minutes setup time for each welded joint before moving.
(i) Repair damaged plastic pipe by replacing the damaged segment.

12. Backflow Prevention Devices: Backflow prevention devices will be installed in a protective cage. The cage will be constructed of a 3/16 inch angle steel frame, with No. 9 expanded steel fabric welded to the frame at each point of contact between the fabric and the frame. The enclosure will include provisions for padlocking, and handles for lifting.

    For devices up to 2 inches, a single hinged cage shall be furnished and installed.

    For devices 2 inches and greater, a double hinged cage that opens from the center shall be furnished and installed.

    The dimensions of the cage will vary depending on the size and type of device required. Consult the enclosure manufacturer's specifications to determine the appropriate model number. A minimum of 6 inches clearance is required between the device and the cage.

13. Control Wiring: Lay the wiring from the remote control valves to the controller. Lay alongside the supply mains where practical. Tape wires together at 10 foot intervals. All wiring passing under existing or future paved walks and roads shall be installed inside PVC Schedule 40 Type II pipe sleeve, of adequate sizes to permit convenient threading of all bundles, as shown on the plans. Wires shall not be taped together inside conduits. The conduit shall extend at least 12 inches beyond the edges of the paved walks or road.

    Wire sizes shall be determined by the number of valves operating on a given wire and the distance from the controller to the farthest valve, as specified by the charts furnished by the

remote control valve manufacturer. Valve wire may be any color other than white. No splices are permitted. Common ground wire must be white and splices are permitted only at remote control valves. Use "3M DBY" wire splices or approved equal when splices are made.

Each remote control valve is to have a dedicated individual 14 GA direct burial wire that is continuous in length to the automatic controller. The common wire is to be 12 GA direct burial and is to be dedicated to the controller it serves. No cross connection of common wires between different controllers will be allowed.

14. Valves Boxes: Valve boxes shall be set to finished grade. Only one remote control valve may be installed in each box.

    Furnish purple valve boxes where reclaimed water is or may be used in accordance with Section 67, "Recycled Water Distribution Systems."

    Remote control valves shall be connected and aligned to provide the most efficient flow of water to the irrigation heads. Each valve is to be enclosed in the specified valve box. The valve box shall be secured on firm soil clear of valves and wiring connections.

    Backfill carefully to prevent settlement and subsequent damage. Each valve box corner is to be set on a brick to prevent settling, with a minimum of one cubic foot of pea gravel installed below the valve.

15. Remote Control Valves: Remote control valves shall be adjusted so that all heads operate within the pressure range recommended by the head manufacturer. Remote control valves shall be adjusted so a uniform distribution of water is applied by the heads to the planting areas for each individual valve system. Make all connections for operation.

16. Flushing of Lines: After all new piping is in place and connected, and all necessary diversion work has been completed, the control valves shall be opened and a full head of water used to flush out the system.

17. Automatic Controllers: Locate controllers in general locations shown, with exact placement to be determined at the job site by the City's representative.

    Connect to 120 volt source(s) provided at the site. Install electrical service pedestal at the connection.

    Use rigid metal conduit above grade, slab, or floor.

    Where specified, provide and install rechargeable battery backup in controllers per the manufacturer's recommendations.

    Connect control wires to controllers in sequential arrangement according to assigned identification numbers on drawings.

    Controllers shall be properly grounded per Article 250 of the National Electric Code and conform to local regulations.
    Reference is made to Section 21-2, "Design," for operating hours. Controllers shall be programmed so as not to apply excess water. Care shall be taken to prevent run-off and

slope/soil erosion caused by prolonged applications of water. **Note: Contractor will be cited and fined for water waste in accordance with Clovis Municipal Code.**

Solar powered controllers shall be installed per manufacturer's recommendation and as directed by the City Inspector.

18. Automatic Controller Schedule: Install automatic controller schedule in laminated plastic or a watertight plastic envelope inside controller cover showing which valves are connected to which stations on controller.

19. Controller Charts: The Contractor shall provide one controller chart for each controller supplied.

20. The chart shall show the area controlled by automatic controller and shall be the maximum size controller door will allow.

21. The chart may be a reduced drawing of the actual "as-built" system. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.

22. Sprinkler Heads: Sprinkler heads located in areas where ground cover planting is indicated shall be set on permanent risers with top of head located above finished grade per plan detail; rotary pop-up sprinkler heads adjacent to walks or roads shall be set 6 inches from edge of walk or road, and pop-up spray heads adjacent to walks or roads shall be set 2 inches from edge of walk or roads.

    Upon completion of the installation, the Contractor shall adjust sprinkler heads to properly distribute water flow and shall place entire irrigation system in correct operating condition.

    Adjust sprinklers so that water spray does not contact structures such as fences, walls, or buildings.

    Adjust sprinkler heads to avoid applying water on roadways, walkways, sidewalks, and other areas that are not landscaped.

    Where reclaimed water is to be used, purple caps shall be provided on sprinklers.

23. Drip Emitters: Upon completion of the installation, the Contractor shall adjust the drip emitters to properly distribute water flow and shall place the entire irrigation system in correct operating condition.

24. Cathodic (Insulation) Protection: Protection shall be installed as follows:

    (a) Between wrapped galvanized steel pipe and unwrapped galvanized steel or cast iron pipe in ground using couplings or flanges.
    (b) Between pipes and equipment, except at sprinkler heads and backflow preventer.
    (c) Between old and new steel piping.
    (d) Wherever brass, copper, or bronze is installed in contact with or adjacent to steel buried in the ground, and also at insulated fittings, junction shall be wrapped with a minimum of two overlapping layers of specified tape. Tape shall follow the contours of the junction

and extend 6 inches or more over the steel and over the brass fittings or valve as far as practical.

(e) Galvanized steel pipe under a concrete slab.

25. Concrete Equipment Pads: Concrete pads shall be provided for all irrigation and electrical equipment in locations approved by the City Inspector.

    All pads shall be installed at finished grade and will be a minimum of 3½ inches thick. All pads shall be installed with the slab extending ½ inch above finish grade. All pads shall be sloped to drain to matching drainage patterns at ¼ inch per foot.

    Unless otherwise directed by the City Inspector, the installer will locate the irrigation controller, backflow preventer, and electrical service panel on a common pad.

21-8 Pressure Test

The Contractor shall notify all necessary parties 48 hours prior to pressure testing. The Contractor is to center load pipe with small amounts of backfill to prevent arching or slipping of pipe under pressure.

All solvent welded pipe joints shall be allowed to set at least 24 hours before any pressure testing can be performed.

All pressure lines shall be tested under hydrostatic pressure of 125 psi after installation. The Contractor shall provide all equipment for such tests. Pressure tests will not be required for non-pressure lateral lines with swing joints.

Pressure shall be sustained in the lines for not less than four (4) hours. If leaks develop, the joints shall be replaced and the tests repeated until the entire system is proven watertight.

Tests shall be observed and approved by the City Inspector prior to backfill. If irrigation lines are plowed into place, all pipe joints are to be exposed for the pressure test.

Upon completion of each phase of the work, the Contractor shall check and adjust each sprinkler head to meet the site requirements and plan.

Water consumed for pressure testing will be charged to the Contractor in accordance with Section 5-13, “Electrical and Water Service,” and Section 17, “Water Use.”

21-9 Backfill And Compaction

Backfill and Compaction shall conform to the applicable requirements of Section 19-3.03, “Trench and Structure Backfill and Compaction.”

Backfill shall not be placed until the installed system has been tested, inspected and approved by the City.

Material shall be approved soil. Unsuitable material, such as pipe remnants, wire, clods and rocks over 2 inches in size, shall be removed from the premises and disposed of legally. Backfill for the first 6 inches around the mainline pipe and control wires shall be sand or native soil approved by the Engineer.

All backfilling shall be done carefully and shall be properly tamped. All soil shall be tamped and jetted to eliminate any voids.

Surplus earth remaining after backfilling shall be disposed of as directed by the City Inspector.

Backfilling for all pipe shall be carried out in two basic stages:

A. Stage One Backfilling:

This shall be accomplished as soon as possible after the pipe is placed. A bedding of uniform depth with no voids must be provided along the entire length of the pipe. The bedding dirt should be placed in the trench and tamped into the areas under the pipe, using a suitable tool. Joints should be left exposed until hydrostatic tests are completed. Cover only those portions of the pipe necessary to prevent movement or damage.

B. Stage Two Backfilling:

This shall be completed after all hydrostatic tests are completed and the piping system has been thoroughly checked for leaks or other defects. Continue to add backfill soil in 4 inch layers and hand tamp to achieve a density similar to adjacent soil. After 12 inches in main line trenches of hand-tamped soil is in place over the pipe and fittings, backfilling can be continued, using light machinery to place dirt in the trenches in 6 inch layers and to compact the dirt to conform to adjacent soil. Extreme care should be taken to avoid damage to the pipe from machinery that is too heavy. All trenches shall then be water jetted to assure uniform settling and compaction. Backfilling operations will not be considered complete until the top surface has been graded to conform to the adjacent soil. All rocks must be collected and removed from the site.

PVC piping and fittings shall not be backfilled during periods of extreme heat or when a sudden lowering of the temperature of the pipe may cause separation of joints or fittings.

21-10 System Testing And Adjustment

After the installation of automatic controller, valves, sprinkler heads, drip emitters and other equipment, the complete system shall be operated in the presence of the Engineer. Any defective or inoperative material shall be repaired or replaced to the satisfaction of the Engineer. The Contractor shall balance and adjust the various components of the system so the overall operation of the system is most efficient. This includes a synchronization of the controllers, adjustments to heads and emitters, and individual station adjustments on the controllers.

When the irrigation system is completed, the Contractor, in the presence of the City Inspector and Parks Division, shall perform a test to check the coverage of the system. The Contractor shall inform the City of any deviation from the plan required due to wind, planting, soil, or site conditions that bear on proper coverage.

The Contractor shall furnish all materials and labor required to correct any inadequacies of coverage due to site conditions or unauthorized deviations from the Plans. If such corrections or additions are required in the sprinkler system, the Contractor shall make all adjustments and corrections without any extra cost to the City.

21-11 Inspection

Reference is made to Section 21-4, “Specialized Inspection.” In addition to the specialized inspection specified in said Section 21-4, periodic inspections shall be required for basic operations and

installations during progression of the work. It shall be the Contractor's obligation to call and schedule inspections, including the City Building Division for work covered under the California Electrical and Plumbing Codes. Inspections will include but not necessarily be limited to the following items:

(a) Grading
(b) Layout and flagging of sprinkler heads and system
(c) Trenching
(d) Pipe and Wire placement
(e) Partial fill compaction of trenches
(f) Control valve installation
(g) Electrical Service installation
(h) Electrical panel installation
(i) Irrigation controller installation and operation
(j) Mainline sustained pressure check
(k) Booster pump installation
(l) Backflow preventer installation
(m) Water Service installation and meter connection

All overtime inspection charges incurred by City personnel shall be paid by the Contractor when inspection services are required outside of normal working hours. Work requiring inspection before or after the normal 8 hours of a normal working day or taking place on holidays, Saturdays and Sundays will be considered overtime inspection.

A pre-final inspection of the work shall be made by the City Engineering and Building Division Inspectors and Parks Division personnel in the presence of the Contractor, at the time when all landscaping and irrigation work is completed and inspection is requested by the Contractor to commence the plant maintenance period. In conformance with Section 20-8, "Maintenance Period," and Section 21-12, "Maintenance Period," the Contractor shall make the inspection requests to the Engineer two working days prior to the requested time of such inspection. After the system has been completed in all respects, the Contractor shall instruct an authorized representative of the City Parks Division in the operation and maintenance of the system and shall furnish a complete set of written operating instructions.

A final inspection of the work shall be made by the inspectors of the City Engineering and Parks Divisions in the presence of the Contractor, at the end of the required maintenance period when all landscaping and irrigation work is completed. The Contractor shall provide 48 hours notification in advance of such inspection. Prior to the final inspection, the Contractor shall have prepared and transmitted to the City a set of Record Drawings ("as-builts") of the landscaping and irrigation work. No final inspection will commence without the Record Drawings.

In the event that the Contractor schedules an inspection and has not completed the work that is to be inspected or made an effort to do so, the Contractor will be billed for the cost of the inspection and must remit the cost prior to final approval and inspection of the work.

21-12 Maintenance Period

A ninety (90) day maintenance period will be required for all irrigation systems. This maintenance period will run concurrently with the landscape planting maintenance period in accordance with Section 20-8, "Maintenance Period." All of the applicable terms and conditions of said Section 20-8, as they apply to the conduct of the maintenance period, shall also apply to this Section 21-12. The maintenance period for landscape irrigation systems shall begin after all landscape construction

activities have been completed, all approved equipment and improvements have been installed, and upon receiving written approval by the Engineer to commence the maintenance period.

The Contractor shall continuously maintain and provide all necessary repairs until a written notice of final acceptance for maintenance is received from the City. The Contractor shall have the charge and 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 not the fault of the City. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work before final acceptance for maintenance.

21-13 Completion

Upon completion of work, including the 90 day maintenance period, the Contractor shall provide to the City:

(a) Two additional keys to each enclosure and controller box;
(b) Two each of any specialized tools required for the operation and/or maintenance of each type of component installed in the system;
(c) Other items as specified in the Plans and Specifications, including a set of Record Drawings ("as-builts") as provided in Section 21-11, "Inspection."

21-14 System Guarantee

In compliance with Section 7-23, "Guarantee," the entire irrigation system shall be guaranteed by the Contractor to give satisfactory service, and the Contractor shall guarantee the quality of materials, equipment and workmanship, including settling of fill areas or backfilled trenches below finish grade, for a period of one year following the date of the filing of the Notice of Acceptance for all of the work by the City.

If, within one year from the date of the filing of the Notice of Acceptance for all of the work, problems develop resulting from inferior or faulty materials or workmanship, or settlement of fill areas or trench backfill occurs requiring adjustments in pipes, valves, emitters, heads, sod, or paving to the proper level of the permanent grades, the Contractor, as part of the work under his Contract, shall make all adjustments and corrections without extra cost to the City, including the complete restoration of all damaged planting, paving, or other improvements of any kind.

21-15 Measurement And Payment

Unless otherwise specified in the Contract Specifications, landscape irrigation systems will be measured and paid for on a lump sum basis for the entire system, complete in every detail. The lump sum price bid for landscape irrigation system shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as specified in the Specifications, and as directed by the Engineer. This shall include, but not be limited to clearing and grubbing, furnishing and installing all equipment such as pipe, fittings, heads, emitters, valves and valve boxes, controllers, wiring, electric service, water service, backflow preventers, filters, providing excavation, backfill and compaction, testing, adjusting, guaranteeing, and all incidentals.

SECTION 22 - FINISHING ROADWAY

Finishing Roadway shall be as specified in Section 22, “Finishing Roadway,” of the State Standard Specifications.

SECTION 23 (BLANK)

BASES AND SUBBASES

SECTION 24 - LIME STABILIZATION

Lime Stabilization shall be as specified in Section 24, "Lime Stabilization," of the State Standard Specifications.

SECTION 25 - AGGREGATE SUBBASES

Aggregate Subbases shall be as specified in Section 25, "Aggregate Subbases," of the State Standard Specifications.

SECTION 26 - AGGREGATE BASES

Aggregate bases shall be as specified in Section 26, "Aggregate Bases," of the State Standard Specifications.

SECTION 27 - CEMENT TREATED BASES

Cement Treated Bases shall be as specified in Section 27, "Cement Treated Bases," of the State Standard Specifications.

SECTION 28 - LEAN CONCRETE BASE

Lean Concrete Base shall be as specified in Section 28, "Lean Concrete Base," of the State Standard Specifications.

SECTION 29 - TREATED PERMEABLE BASES

Treated Permeable Base shall be as specified in Section 29, "Treated Permeable Bases," of the State Standard Specifications.

SECTION 30 - THROUGH 36 (BLANK)

SURFACING AND PAVEMENTS

SECTION 37 - BITUMINOUS SEALS

Bituminous Seals shall be as specified in Section 37, "Bituminous Seals," of the State Standard Specifications.

SECTION 38 (BLANK)

SECTION 39 - ASPHALT CONCRETE PAVEMENT, DIKES

Asphalt Concrete pavement, other asphalt surfacing, and dikes shall be as specified in Section 39, "Asphalt Concrete," of the State Standard Specifications.

SECTION 40 - PORTLAND CEMENT CONCRETE PAVEMENT

Portland Cement Concrete Pavement shall be as specified in Section 40, "Portland Cement Concrete Pavement," of the State Standard Specifications.

SECTION 41 - THROUGH 62 (BLANK)

MUNICIPAL UTILITIES AND FACILITIES

SECTION 63 - STORM DRAINAGE FACILITIES

All storm drainage facilities including pipelines, inlets, manholes, and all appurtenances, whether temporary or permanent, shall be as specified in the current Fresno Metropolitan Flood Control District Standard Specifications and Standard Drawings.

EXCEPTION: Trench and structure excavation and backfill for drainage facilities located in City of Clovis easements and public rights-of-way shall conform to the provisions in Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration," of these Standard Specifications. Temporary storm drain facilities shall conform to the applicable City Standard Drawings. Location or relocation of storm drains or laterals shall conform to Section 64-11, "Alignment Changes (Separation Criteria)," of these Specifications.

SECTION 64 - SANITARY SEWER FACILITIES

64-1 General

This work shall consist of furnishing all sewer main pipelines, branch fittings, building or house branches (services), manholes, stub-outs, lampholes, and other sewer facilities as shown on the Plans and in conformance with the Standard Drawings, as specified in the Specifications, and as directed by the Engineer, including testing and internal inspection of all sewer main pipe after installation.

64-2 Materials

64-2.1 PVC Pipe And Fittings

Unless otherwise specified in the Contract Specifications, pipes for sanitary sewer mains, fittings, and building and house branches (services) shall be polyvinyl chloride (PVC), as specified herein.

PVC pipe shall conform to the provisions in the ASTM Standard Specifications tabulated below, for the standard dimension ratio (SDR) or pipe stiffness (PS) designation given, and these specifications.

Pipe Size (Inches)	ASTM	SDR or PS
4-15	D3034	SDR 35
18-30	F679	PS 115

PVC pipe and fittings shall be manufactured of PVC compound containing not more than 10 parts per 100, by weight, of additives and fillers, including but not limited to, stabilizers, antioxidants, lubricants, and colorants.

PVC pipe and fittings for sanitary sewers and sewer services shall be green in color.

Chemical Resistance: PVC pipe shall have the properties in the following table, when tested before and after exposure to certain chemical solutions as specified in the American Public Works Association Standard Specifications for Public Works Construction "Greenbook," Section 207-15.3, as amended.

Property	ASTM Test Method	Allowable Change (After 112-Days Exposure)		
Minimum Yield Strength (psi)	D 638	- 0% (No Reduction)		
Impact Strength (Ft. - lbs/in.) Notch Min.	D 256 Method A (Size ½" x ⅛" x 2½")	- 0% (No Reduction)		
Weight Change % Unconditioned Conditioned	D 543	 ±1.5 max ±1.0 min	 ±1.5 max ±1.0 min	 ±1.5 max ±1.0 min

PVC Pipe shall be clearly marked as follows at intervals of five feet or less:

Manufacturer's name or trademark	Legend "Type PSM SDR-35 PVC Sewer Pipe"
Nominal pipe size	ASTM D3034
PVC cell classification	(12454-B or 12454-C or 13364-B)

PVC pipe fittings shall conform to the provisions in ASTM F1336 and these specifications. PVC fittings and accessories shall be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations identical to that of the pipe. Where shown on the Plans, injection molded PVC wye fittings shall be used for future building or house branch connections at the time of installation of the sanitary sewer main. Where indicated on the Plans or specified in the Contract Specifications, each wye branch for future sewer service connections shall be provided with an end cap or plug approved by the pipe manufacturer for use with its product.

PVC Fittings shall be clearly marked as follows:

Manufacturer's name or trademark	"PSM"
Nominal size	"ASTM D3034"
Material Designation	"PVC"

64-2.2 Joints And Gaskets

Joints shall be integral bell and spigot push-on joints conforming to the provisions in ASTM D3212 and these Special Provisions, with factory installed elastomeric gaskets. Joints shall be configured so as to prevent improper installation of the gasket and ensure that the gasket remains in place during the joining operation. Bell and spigot configurations for fittings and couplings shall be compatible with those used for pipe joints.

Spigots shall have a home mark to indicate proper penetration when the joint is made.

Elastomeric gaskets shall conform to the provisions in ASTM F477 for thermoset elastomeric gaskets, and these specifications. Gaskets shall be factory installed by the pipe manufacturer, and shall be specifically intended for use with the pipe.

Gaskets shall be manufactured from a synthetic elastomer, containing not less than 50% by volume of first-grade synthetic rubber. The remainder of the compound shall consist of pulverized fillers free of rubber substitutes, reclaimed rubber, and deleterious substances.

A gasket shall contain no more than one splice. A splice shall be made by applying a suitable cement to the ends and vulcanizing the splice in a full mold.

64-2.3 Test Requirements

During production of the pipe, the pipe manufacturer shall perform the tests specified in ASTM D3034. A certificate of compliance with specification requirements shall be provided by the manufacturer, for each lot of pipe from which pipe is delivered, and shall be delivered with the pipe. The certificates of compliance shall include the test results. The Contractor shall submit the certificates of compliance to the Engineer prior to commencing excavation for installation of the pipe.

In addition, when so directed by the Engineer, the Contractor shall obtain PVC compound samples and shall provide test specimens in accordance with ASTM D1987. The Contractor shall also provide one test pipe selected at random by the Engineer from each 1200 feet or fraction thereof, or from each pipe lot or fraction thereof. A lot shall be defined as all pipe having identical identification marking. The length of test pipe for each selected pipe shall be a minimum of 8 feet. The Engineer may test the specimens for compliance with specification requirements.

When so directed by the Engineer, the Contractor shall furnish test specimens of gaskets from each batch used in the work.

When the pipe is delivered to the work site, the Engineer may require additional testing to determine conformance with specification requirements for pipe flattening, impact resistance, pipe stiffness, and extrusion quality.

The basis for acceptance will be compliance with specification requirements, as determined by the inspection of pipe, fittings, and couplings, the certificates of compliance, and the results of any tests conducted by the Engineer.

64-2.4 Time Limit For Installation

If the Contractor proposes to install any PVC pipe and fittings that are more than 180 days old from the date of manufacture, the Contractor shall retest the materials within 60 days prior to installation, at the Contractor's expense, to demonstrate compliance with specification requirements, unless otherwise directed by the Engineer. The Contractor shall not install any PVC pipe and fittings more than 2 years old from the date of manufacture. PVC pipe that is stored for more than 3 weeks under conditions that may subject the pipe to sunlight or other sources of ultraviolet light shall be covered or otherwise protected from such exposure to prevent pipe material degradation ultraviolet radiation. The foregoing shall also apply to elastomeric gaskets.

64-2.5 Vitrified Clay Pipe

Vitrified clay pipe and fittings shall only be used if required by the Plans or Contract Specifications. In such case, vitrified clay pipe, shall be extra strength, bell and spigot, and shall conform to ASTM Specification Designation C-700 with preformed factory fabricated plastisol joints complying with ASTM Specification Designation C-425-04. Vitrified clay sewer pipe shall also conform to standards of the Clay Products Institute.

64-2.6 Manhole Materials

Cast-in-Place Concrete:

Concrete for cast-in-place manholes shall be Class 2 concrete conforming to the provisions in Section 90 of the State Standard Specifications, unless otherwise shown on the Plans or specified in the Contract Specifications. Portland cement shall be Type II low alkali sulfate resistant conforming to the provisions in ASTM C150. Slump shall not exceed 3 inches. Before using concrete, the Contractor shall submit in writing to the Engineer a copy of all mix designs.

Precast Reinforced Concrete Manhole Sections:

Precast reinforced concrete manhole sections for manholes shall conform to the provisions in ASTM C478. Elliptical single line reinforcement is not allowed. The ends of manhole sections shall be in planes at right angles to the longitudinal axis of the section. The ends of manhole sections shall be finished to regular smooth surfaces, and no point on any surface of either the spigot end or bell end shall project beyond, or be more than 1/4 inch short of, the specified plane.

In addition to the tongue and groove joints shown on the Standard Drawings, joints for manhole sections may be rubber gasket joints of flush bell and spigot design with a contained rubber gasket. Joints and gaskets shall conform to the provisions in ASTM C443 for standard gaskets, except as modified or required otherwise in these Special Provisions. The gasket shall be confined in a groove or by a shoulder on the spigot end of the manhole section so that neither movement of the section nor hydrostatic pressure can displace the gasket. When the joint is assembled, the gasket shall be compressed to effect a watertight seal.

Rubber gasket joint assemblies shall be formed and accurately manufactured so that installed manhole sections will form a continuous watertight manhole with a smooth and uniform interior surface, and shall provide for slight movements of the sections due to expansion, contraction, settlement, or lateral

displacement. The shape and dimensions of the joint shall be such that it shall be self-centering upon closure, and so designed that the gasket will not be required to support the weight of the manhole sections. The rubber gasket shall be the sole element of the joint depended upon to provide water-tightness.

Manhole adjustment rings shall be precast concrete manhole adjustment rings conforming to the details shown on the Standard Drawings.

Mortar used in manholes shall be composed of one part, by weight, Portland cement (Type II low alkali conforming to ASTM C150) and 2 parts, by weight, sand.

Steel reinforcement bars shall be deformed billet-steel bars of the size called for in the Plans and Specifications, conforming to the provisions in ASTM A615 for Grade 60.

Metal frames and covers for manholes shall be cast iron meeting the provisions in ASTM A48 for Class 25, and shall conform to the details shown on the Plans and Standard Drawings. Covers shall be marked "Sanitary Sewer," molded into the cover by the manufacturer.

64-3 Trenching And Excavation

Trenching for sanitary sewer pipes and service laterals, and excavating for sewer manholes shall conform to the requirements of Section 8-15, Utilities and Non-Street Facilities; Potholing," and Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration."

64-4 Sewer Pipeline Installation

Construction of sewer pipelines connecting to existing sewers shall begin at the existing sewer location and proceed upstream with the spigot end of the pipe in the direction of flow, unless otherwise approved in writing by the Engineer. Existing sewer lines shall remain operational at all times. The Contractor shall furnish and install a gasketed stainless steel band-type repair coupling specifically designed for such use and approved by the Engineer where PVC sewer pipe is to be connected to an existing pipe.

Sewer pipe and fittings shall be laid to true line and grade, and jointed in compliance with the manufacturer's recommendation and shall be carefully adjusted to grade by scraping away or filling and tamping the trench bottom to eliminate any possible sag or high point in the pipe. Occasional variations as follows will be permitted: above grade, 3/16 inch; below grade, not to exceed 3/8 inch; alignment not to exceed 2 inches if gradual over a distance of 20 feet. Use of blocks to support the pipe is prohibited. Each joint of pipe must be fully pressed into place so that there will be no unevenness or settlement of one length of pipe with the other at the joint.

The Contractor shall furnish and use a laser device for control of alignment and grade of the sewer pipe. When conditions are such that this method is impracticable, such as on short pipe runs, the Contractor shall have an Engineer on the ground to set grade of each joint of pipe by means of an Engineer's level. The grade line shown on the Plans indicates the flow line or invert of the pipe; all cuts, unless otherwise indicated, refer to this line.

The interior of the pipe shall be kept free from dirt and other foreign material as the laying progresses. Any pipe that shows undue settlement or is damaged shall be taken up and replaced or re-laid at the Contractor's expense. The open ends of all sewer pipes being installed must be covered to keep out animal life, etc., whenever the pipe is left unattended for any length of time, such as overnight. The end of any sewer that does not terminate at a manhole shall be closed at the bell end with a plug manufactured for that purpose.

PVC pipe exposed to the sun during the summer months must be allowed to cool before connection is made to manholes and other facilities, and prior to backfill.

64-5 Service Lateral Installation

Service laterals shall be furnished and installed by the Contractor at the locations shown on the Plans, in conformance with the Standard Drawing pertaining thereto, the Contract Specifications, and the directions of the Engineer.

Pipe for sewer service laterals shall conform to the requirements of Section 64-2.1, "PVC Pipe and Fittings," and shall be installed in accordance with the requirements of Section 64-4, "Sewer Pipeline Installation."

Sewer service laterals 4 inches or 6 inches in diameter shall be connected to all sewer mains less than 18 inches in diameter at prefabricated wye fittings conforming to Section 64-2.1, "PVC Pipe and Fittings," or shall be connected to similar pipe stub-outs from manholes. Sewer service laterals 4 inches or 6 inches in diameter may be connected directly to existing sewer mains 18 inches in diameter or greater, providing that a machine core is used in connecting to the main sewer. Sewer service laterals 8 inches in diameter or greater connecting to sewer mains shall require the construction of a manhole at the point of connection. All connections shall be of materials and methods as approved by the Engineer.

Sewer wye fittings, unless otherwise specified or directed, shall be inclined at an angle of not greater than 45° from the horizontal. Service laterals shall extend from the sewer main to the right-of-way line of the street or alley, where the service lateral shall be promptly closed at the bell end with a plug manufactured for that purpose.

The Contractor shall mark the location of the end of the service lateral by putting an "S" mark on the curb face. Said mark is to be chiseled into existing concrete or stamped if the concrete is freshly poured. In cases where a concrete curb does not exist, the Contractor shall mark the location of the terminus of the building or house branch for future location by driving an iron pipe or rod in the trench backfill at the end of the pipe as shown on the Standard drawing.

Excavations for laying service laterals shall be made in accordance with the Plans or Contract Specifications. Where no direction is given, service laterals shall be installed in such a manner that: 1) at no time will an existing street be closed to traffic; 2) Whenever service laterals are to be installed in existing major streets that have been resurfaced within the last five years, or in pavement that is in good condition and free of cracking, they shall be installed by boring methods rather than open cut trenches. Laterals crossing over water mains shall comply with Section 64-11 "Alignment Changes."

64-6 Manhole Construction

Manhole structures shall be constructed at the locations shown on the Plans and as specified in the Contract Specifications, and as indicated on the standard drawings pertaining thereto. Construction of Manholes shall comply with Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration," and Section 64-2.6, "Manhole Materials."

Manholes shall be complete structures in place and backfilled including the furnishing and placing of all materials involved. Cast-in-Place Concrete manholes shall consist of a poured-in-place base and riser section, reinforced concrete reducing cone sections. Pre-cast concrete pipe manholes shall consist of a poured in place concrete base section, reinforced concrete pipe riser and reducing cone sections. Both types shall have a cast iron frame and cover and a poured in place concrete collar with paving patch. Invert channels shall be smooth and semicircular in shape conforming to the inside of

the adjacent pipe invert, or flow channels may be provided by use of the bottom half of the specified main pipe. The floor and wall of the manhole outside the channels shall be smooth and shall slope toward the channels.

The top of the manhole 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 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.

The joints between the base and all precast elements of the manhole, including adjustment rings and manhole frame, shall be filled with cement mortar, or approved equal, 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.

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

Stub-outs shall be installed in manholes at the locations and sizes shown on the Plans. All stub-outs shall be sealed with a plug of a type approved by the manufacturer of the pipe.

All manholes shall be completed to finish grade with concrete collar and paving patches (where indicated) as shown on the Standard Drawings and as herein specified. In undeveloped areas where no street or alley surfacing is to be done in conjunction with or immediately after utility installation, the manhole cover shall be finished off to a level 1 inch above ground elevation and shall be provided with 12 inches of grade rings. In existing street areas where surfacing exists and no new street re-grading is contemplated in conjunction with or immediately after utility installation, the manhole cover shall be brought to existing street grade and finished off. In areas where street or alley surfacing is to be done in conjunction with or immediately after utility installation, such as new subdivisions, manholes shall initially terminate with the top of the cone 6 inches below subgrade and shall be brought to street or alley surface with grade adjustment rings and completed after street paving is accomplished. Unless specifically otherwise indicated in the Contract Specifications, it will be the responsibility of the sewer Contractor to return and install the manhole covers to finish grade as specified and as shown on the Standard Drawings.

The Contractor should be aware that connections to existing sewers will be "wet" and the Contractor shall make whatever arrangements are necessary to complete the manhole connections under the "wet" conditions.

Where necessary, mounds or dikes shall be placed around the perimeter of manhole covers to prevent rainwater or other inflow of water from entering the manholes. No steps shall be installed in manholes unless otherwise noted on the plans.

64-7 Backfill, Compaction, And Surface Restoration

Backfilling, compacting and restoration of surfaces of trenches and excavations for sewer facilities shall conform to the requirements of Section 19-3, “Trench and Structure Excavation Backfill, Compaction, and Surface Restoration”

64-8 Leakage Test, Sewer Mains And Service Laterals

After completing the installation, backfill and compaction of a section of sewer main pipeline with service laterals, and after all other underground utilities including City, other agency, and privately owned utilities are in and compacted, but prior to the placement of aggregate base or asphalt-concrete pavement, and prior to conducting the deflection tests and video inspection as required herein, the Contractor shall, at his expense, conduct a leakage test using low pressure air. The test shall be performed using the following procedures and under the supervision of the inspecting Engineer.

Each section of sewer between two successive manholes shall be tested by plugging all pipe outlets with suitable test plugs.

All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 pounds per square inch gauge pressure (psig). The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

To commence the leakage test, air shall be slowly added until the internal pressure is raised to 4.0 psig. The compressor used to add air to the pipe shall have a blow-off valve set at 5 psig to assure that at no time the internal pressure in the pipe exceeds 5 psig. The internal pressure of 4 psig shall be maintained for at least two minutes to allow the air temperature to stabilize after which the air supply shall be disconnected and the pressure reduced to 3.5 psig. The time in minutes that is required for the internal air pressure to drop from 3.5 psig to the lower pressure indicated in the appropriate table below shall be measured and the results compared with the values tabulated below.

Gauges used to measure test pressures shall read from 0 psig to 10 psig (maximum) with 1/2 psig increments. If required, the Contractor shall supply necessary fittings to accept a City supplied gauge.

All gauging and testing shall be done outside the manholes and no one shall be allowed to enter the manholes while the line is pressurized.

PVC Gravity Sewer Pipe Minimum Acceptable Time Required for
Pressure Decrease from 3.5 to 3.0 psig

Pipe Diameter (inches)	Test Time (Minutes)	(Seconds)
4	2	32
6	3	50
8	5	6
10	6	22
12	7	39
15	9	30

Pipes greater than 15 inches diameter shall be as specified in the Contract Specifications.

Vitrified Clay* Sewer Pipe Minimum Acceptable Time Required for
Pressure Decrease from 3.5 to 2.5 psig.
* Only if this kind of pipe is required on the Plans or specified in the Contract Specifications.

Pipe Diameter (inches)	Test Time (Minutes)	Test Time (Seconds)	Minimum Distance Between Manholes (Feet)	K Value
4	2	0	430	0.428
6	2	45	380	0.592
8	3	45	320	0.702
10	4	46	260	1.100
12	5	40	215	1.580
15	7	0	170	2.470
18	8	36	145	3.560
21	10	6	125	4.850
24	11	6	105	6.340

Pipes greater than 24 inches in diameter shall be as specified in the Contract Specifications.

The above-tabulated values shall be used for the respective diameter pipes except where the distance between successive manholes is less than the above-tabulated values, in which case, the following formula will be used to determine the test time:

T=KL
where:
T=test time in seconds
K=value from table
L=distance between successive manholes in feet

Failure of the leakage test will be grounds for rejection of the section tested, until discovery and correction of the reason for the failure and successful retesting of the section.

64-9 Deflection (Deformation) Test, PVC Sewer Pipelines
PVC sewer pipe, which is designated as flexible in nature, shall be tested for excessive deflection. This test shall be performed after backfilling and compaction but prior to the placement of aggregate base or asphalt-concrete surfacing, and prior to television inspection as specified in Section 64-10, "Television Inspection, Installed Pipe Interior"

The Contractor shall demonstrate that the maximum pipe deflection (deformation) does not exceed 5 percent of the nominal pipe interior diameter by pulling a properly sized rigid ball or a mandrel through the main line pipe. A "rubber flush ball" does not meet the requirement for deflection testing.

Failure of the deflection test shall be grounds for rejection of the section tested. The Contractor shall undertake measures necessary to correct the deflection. Retesting of the failed section will be conducted to affirm correction. If correction requires re-laying or otherwise disturbing the pipe, the Contractor may be required by the Engineer to repeat the leakage test at no cost to the City.

64-10 Television Inspection, Installed Pipe Interior
The Contractor shall furnish closed circuit television equipment for an interior inspection of the newly installed sewer mains. The television inspection of the sewer mains shall be made after

leakage and deflection tests have been performed and prior to placing of street aggregate base or asphalt paving. Any broken pipe, separation of joints, or any pipe exceeding the permitted tolerances for line and grade shall be replaced or repaired. Any pipe repaired or replaced shall be retested for leakage and deflection. A DVD disc showing the initial video inspection as well as any retests shall be provided to the City at no additional cost.

The Contractor shall be responsible for all costs associated with furnishing the television inspection and making final repairs to the sewer mains and re-inspection utilizing the closed circuit television equipment.

64-11 Alignment Changes (Separation Criteria)

All non-potable water mains, which include sanitary sewers, sewer force mains, recycled water mains, storm drains, and potable water mains must meet the separation standards of the "California Waterworks Standards", contained in Section 64572, Title 22, of the California Administrative Code, or shall be installed in accordance with alternate construction criteria as specified therein. Included in the Appendix to these Specifications is a document titled "Guidance Memo No. 2003-02: Guidance Criteria for the Separation of Water Mains and Non-Potable Pipelines" published by the California Department of Health implementing said Section 64572. This document sets forth minimum spacing requirements between drinking water pipelines and sewer and other non-potable water pipelines, and has been used to set the location of the sewer main. In the event that field conditions require a change in the planned alignment (horizontal or vertical) of the sanitary sewer, under no circumstances shall a change be made without obtaining the express and written approval of both the City inspector and the City Design Engineer. Any change so authorized must comply with the Guidance Memo.

64-12 Measurement

Measurement for sewer main installation and service lateral installation shall be by the lineal foot of pipe installed, and shall be the actual horizontal length installed, measured through wye fittings. Wyes will not be measured separately when constructed with a lateral.

Where wyes are to be installed for future lateral connections, measurement for wye fittings shall be per each wye fitting installed.

Measurement for manholes shall be per each manhole installed.

64-13 Payment

The unit price bid per lineal foot for sewer mains shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in these Specifications and the Contract Specifications, and as directed by the Engineer. This shall include, but not be limited to, furnishing and installing the pipe, trenching, backfilling, compacting, leakage and deflection testing, and internal video inspection.

The unit price bid per lineal foot for service laterals shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include, but not be limited to, furnishing and installing the wye fitting, pipe, trenching, backfilling, compacting, plugging and marking, and leakage testing.

The unit price bid per each for wye fittings, where wye fittings only (no lateral) are to be installed, shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer, in excess of the cost of installing main line pipe. This shall include,

but not be limited to, furnishing and installing the wye fitting and plug, trenching, backfilling, compacting, leakage testing and internal video inspection.

When the contract does not include a pay item for wye fittings as above specified, and unless otherwise provided in the Contract Specifications, full compensation for wye fittings shown on the plans shall be considered as included in the prices bid for other sewer pipeline items of work and no separate payment will be made therefor.

The unit price bid per each for manholes shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include, but not be limited to, furnishing and installing the manhole and pipe stub-outs, excavation, backfill and compaction, returning and adjusting manhole lids and frames to final grade following street or alley construction or reconstruction, and connections to all pipes, wet or otherwise.

SECTION 65 - SANITARY SEWER FORCE MAINS

65-1 General

This work shall consist of furnishing and installing Poly Vinyl Chloride (PVC) and Ductile Iron (DI) pipe for sewer force mains, and all appurtenances, installed complete as shown on the Plans, as specified in the Specifications, and as directed by the Engineer. Reference is made to Section 64, "Sanitary Sewer Facilities," and Section 66, "Potable Water Distribution Facilities," of these specifications.

65-2 Materials

Pipe for sewer force mains shall be either PVC pipe or DI pipe.

Where a particular pipe material, either PVC pipe or DI pipe, is designated on the Plans for sewer force main construction, the sewer force main pipe material shall be as shown on the Plans.

Where a particular pipe material is not designated on the Plans for sewer force main construction, and sewer force mains are installed in slurry cement backfill as shown on the Plans, sewer force mains may be either PVC pipe or DI pipe, at the Contractor's option, except where thrust restraint is accomplished by the use of restrained joints. Where thrust restraint is accomplished by the use of restrained joints, sewer force mains shall be DI pipe.

Where a particular pipe material is not designated on the Plans for sewer force main construction, and sewer force mains are not installed in slurry cement backfill as shown on the Plans, sewer force mains shall be DI pipe.

All pipe fittings for sewer force mains shall be DI fittings, conforming to the requirements of AWWA C110 for Class 250

65-2.1 PVC Pipe

PVC pipe for sewer force mains in sizes from 4 through 12 inches in diameter shall be Class 150, conforming to the requirements of AWWA C900 for DR18. PVC pipe for sewer force mains in sizes from 14 through 36 inches in diameter shall be PR 165, conforming to the requirements of AWWA C905 for DR 25. Pipe joints shall be integral bell and spigot gasketed joints conforming to the requirements of ASTM D 3139, with an elastomeric seal (gasket) conforming to the requirements of ASTM F 477, unless otherwise shown on the Plans or specified in these specifications or the Contract Specifications. The pipe shall be manufactured with standard cast iron pipe outside diameters, and the nominal laying length shall be 20 feet. The pipe shall be green in color, and shall be factory marked to indicate that it conveys wastewater not for potable use.

65-2.2 DI Pipe

Ductile iron (DI) pipe for sewer force mains shall be either Thickness Class 50 or Pressure Class 250 for pipe 16 inches in diameter or smaller, and either Thickness Class 50 or Pressure Class 200 for pipes larger than 16 inches in diameter, conforming to the provisions in Section 66, "Potable Water Distribution Facilities," of these Specifications and the Contract Specifications. The pipe shall be manufactured with standard cast iron pipe outside diameters, and the nominal laying length shall be 18 feet.

The interior surface of all DI pipe and fittings for sewer force mains shall be lined with a factory-applied lining of either:

1. Protecto 401 ceramic epoxy lining, a product of Induron Coatings, Inc., www.protecto401.com, having a nominal thickness no less than 40 mils; or

2. PolybondPlus composite fusion-bonded epoxy and polyethylene lining, a product of American Cast Iron Pipe Company, www.acipco.com, having a nominal thickness no less than 60 mils;

or approved equal. Factory application of the lining, and any necessary field applications for repairs, shall conform to the recommendations of the lining manufacturer and the pipe manufacturer.

DI pipe for sewer force mains shall be installed with a green, 8-mil polyethylene wrap conforming to the provisions in AWWA/ANSI C105/A21.5. The polyethylene wrap shall be marked with the words "CAUTION: RAW SEWAGE – DO NOT DRINK", or approved equivalent, arranged in two continuous lines of text, each on opposite sides of the polyethylene wrap.

65-2.3 Plug Valves

Plug valves shall be of the non-lubricated, eccentric type and shall be designed for a working pressure of 175 psi for valves 12 inch and smaller, and 150 psi for valves 14-inch and larger. Valves shall provide tight shut-off at rated pressure. All plug valves shall be from the same manufacturer. Plug valves shall be Ballcentric Plug Valves as manufactured by the Henry Pratt Company available from the Southwest Valve and Equipment Company at www.southwestvalve.com, or approved equal.

Plug valve bodies shall be cast iron, conforming to the provisions of ASTM A126 for Class B, with a welded-in overlay of 90% nickel alloy content on all surfaces contacting the face of the plug. The seat thickness shall be a minimum of 0.125 inch. Sprayed, plated, nickel welded rings or seats screwed into the body are not acceptable.

The valve plug shall be constructed from ASTM A536, Grade 65-45-12 ductile iron. The plug shall be one piece construction, and shall be encapsulated with a Buna-N elastomer. The plug shall provide full bi-directional shutoff capability. The closed position travel stop for the plug shall be externally adjustable.

Valve flanges shall conform to the provisions of ANSI B16.1 for Class 125. Flanged ends shall be fastened with ANSI Type A304 stainless steel nuts and bolts.

Plug valves shall be furnished with permanently lubricated, sleeve Type 326 stainless steel metallic bearings. Grit excluder seals shall be provided in the upper and lower journals to isolate the bearings.

Plug valve shaft seals shall be the self adjusting type, replaceable without removing the valve bonnet. Shaft seal shall be rated for pressure or vacuum service. Externally adjustable packing gland is not allowed

Manual gear actuators shall be totally enclosed worm and gear type permanently lubricated.

For valves 2½ to 20 inches in nominal size, the flow way shall be round, 100 percent open area, full port design. For valves greater than 20 inches in nominal size, the flow way shall be round or rectangular, 100 percent open area, full port design.

All interior ferrous surfaces exposed to fluid flows shall be factory coated with a thermo-setting 2-part epoxy or fusion epoxy coating having a minimum dry thickness of 8 mils. All exterior ferrous surfaces shall receive two coats of Plasite 7122, as produced by Carboline Company, www.carboline.com, or approved equal, with each coat having a different color and being 6 to 8 mils in dry thickness. All linings and coatings shall conform to the manufacturer's recommendations.

Buried plug valves shall be fitted with necessary gear box, valve well, valve stem extension, operating nut, diviner position indicator, valve box, valve box lid and concrete collar. Valve stem extension shall be installed when operating nut exceeds a depth of 4 feet as measured from final grade

of valve box rim. Final grade shall be existing, proposed, or future grade of the valve box rim as shown on the Plans or as directed by the Engineer.

65-2.4 Thrust Blocks

Unless otherwise specified in the Plans or Contract Specifications, concrete for thrust blocks shall be Class 1, 2, 3, or 4 conforming to Section 90, "Portland Cement Concrete," of the State Standard Specifications.

65-3 Force Main Installation

Sewer force mains shall be installed as shown on the Plans, and shall conform to the requirements of Section 8-15, "Utility and Non-Street Facilities; Potholing," Sections 19-3, "Trench Excavation, Backfill, Compaction, and Surface Restoration," and 64-4, "Sewer Pipeline Installation," the Contract Specifications, and the pipe manufacturer's recommendations. Where required by the Plans or the Contract Specifications, slurry cement backfill for sewer force main installation shall conform to the provisions in Section 19-3.062, "Slurry Cement Backfill," of the State Standard Specifications. Slurry cement backfill shall attain a minimum compressive strength of 300 psi at 7 days. Coloring of slurry cement backfill, if required by the Contract Specifications, shall conform to the requirements therein.

Thrust restraint for all sewer force mains shall be accomplished by the use of restrained joints, in conformance with the details shown on the Plans. Thrust blocks are not acceptable for thrust restraint for sewer force mains.

65-4 Tracer Wire Installation

A tracer wire shall be installed with all pipe for sewer force mains. Materials and installation shall conform to Sections 66-2.12, "Tracer Wire," and 66-6, "Tracer Wire Installation."

65-5 Plug Valve Installation

Plug valves shall be furnished and installed at the locations as shown on the Plans, as specified in the Specifications, and as directed by the Engineer. Reference is also made to Section 66, "Potable Water Distribution Facilities."

Plug valves shall be installed such that the plug rotates about a horizontal axis. Plug valves shall be installed in a manner to allow the plug to be stored in the top when the valve is open, thus protecting the plug against grit and heavy solids that may pass through the valve. Plug valves shall be installed such that they seat in the direction opposite the high pressure side such that the pressure of the water forces the plug against the seat for a tighter seal.

Plug valve box installation shall conform to the applicable details shown on the City Standard Drawing for valves, except that the cover shall be marked "SEWER".

65-6 Leakage Testing

After completing the installation, backfill and compaction of a section of sewer force main, and after all other underground utilities including City, other agency, and privately owned utilities are in and compacted, but prior to the placement of aggregate base or asphalt-concrete pavement, and prior to conducting the deflection tests and video inspection as required herein, the Contractor shall, at his expense, conduct a leakage test using hydrostatic pressure. The test shall be performed in accordance with the procedures set forth in Section 66-12, "Hydrostatic Pressure Test," and under the supervision of the Engineer.

The Contractor shall provide all water necessary for hydrostatic testing in conformance with the provisions in Section 17, "Water Use." The Contractor shall make all arrangements and pay all fees

necessary for the lawful disposal of water discharged during hydrostatic testing operations. Water so discharged may be used by the Contractor for construction purposes, with the prior written approval of the Engineer.

The length of installed sewer force main which has not passed hydrostatic testing at any particular time during work under Contract shall not be more than 1,400 lineal feet, unless specifically directed or allowed otherwise by the Engineer in writing. The Contractor shall provide additional lengths of restrained pipe, and/or other measures and facilities, as may be necessary to comply with this requirement.

65-7 Deflection (Deformation) Test, PVC Sewer Force Mains

Where shown on the Plans or specified in the Contract Specifications that PVC sewer force mains are to be tested for deformation, this test shall be performed after backfilling and compaction but prior to the placement of aggregate base or asphalt concrete surfacing, and prior to television inspection specified in Section 65-8, "Television Inspection, Installed Pipe Interior." The Contractor at his expense shall provide any necessary special measures to allow access to the pipe interior for testing equipment, and when complete, shall restore and seal the pipeline opening to the satisfaction of the Engineer.

The Contractor shall demonstrate that the maximum pipe deflection (deformation) does not exceed 5 percent of the nominal pipe interior diameter by pulling a properly sized rigid ball or a mandrel through the main line pipe. A "rubber flush ball" does not meet the requirement for deflection testing.

Failure of the deflection test shall be grounds for rejection of the section tested. The Contractor shall undertake measures necessary to correct the deflection. Retesting of the failed section will be conducted to affirm correction. If correction requires re-laying or otherwise disturbing the pipe, the Contractor may be required by the Engineer to repeat the leakage test at no cost to the City.

65-8 Television Inspection, Installed Pipe Interior

The Contractor shall furnish closed circuit television equipment for an interior inspection of the newly installed sewer force mains. The television inspection of the mains shall be made after leakage and deflection tests have been performed passed, and prior to placing of street aggregate base or asphalt paving. Any broken pipe, separation of joints, or any pipe exceeding the permitted tolerances for line and grade shall be replaced or repaired. Any pipe repaired or replaced shall be retested for leakage and deflection. A DVD disc showing the initial video inspection as well as any retests shall be provided to the City at no additional cost.

The Contractor shall be responsible for all costs associated with furnishing the television inspection and making final repairs to the sewer force mains and re-inspection utilizing the closed circuit television equipment.

65-9 Alignment Changes (Separation Criteria)

All non-potable water mains, which include sewer force mains, sanitary sewers, recycled water mains, storm drains, and potable water mains must meet the horizontal and vertical separation standards of the "California Waterworks Standards", contained in Section 64572, Title 22, of the California Administrative Code, or shall be installed in accordance with alternate construction criteria as specified therein. Included in the Appendix to these Specifications is a document titled "Guidance Memo No. 2003-02: Guidance Criteria for the Separation of Water Mains and Non-Potable Pipelines" published by the California Department of Health implementing said Section 64572. This document sets forth minimum spacing requirements between drinking water pipelines and sewer or reclaimed water pipelines, and has been used to set the location of the sewer force main. In the event that field

conditions require a change in the planned alignment (horizontal or vertical) of the sewer force main, under no circumstances shall a change be made without obtaining the express and written approval of both the City inspector and the City Design Engineer. Any change so authorized must comply with the Guidance Memo.

65-10 Measurement

Measurement for sewer force main installation shall be by the lineal foot of pipe installed, and shall be the actual horizontal length installed, measured through fittings (if any).

Measurement for plug valves shall be on a per each basis, installed.

65-11 Payment

The unit price bid per lineal foot for sewer force mains shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include furnishing and installing the pipe, couplings or special joints, trenching, backfilling, compacting, leakage and deflection testing, and internal video inspection.

Unless otherwise specified in the Contract Specifications, or if no bid item is included in the contract therefor, the cost of any fittings shall be considered as included in the cost of sewer force main, and no additional compensation will be paid therefor.

The unit price bid per each for plug valves shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as specified in the Specifications, and as directed by the Engineer. This shall include furnishing and installing the valve, valve box, and valve extension, installing concrete thrust blocks, trenching, backfilling, compacting, testing, sterilization, pressure testing, water, returning and installing valve box to final grade following trench surface restoration, street or alley construction or reconstruction, and all incidentals.

SECTION 66 - POTABLE WATER DISTRIBUTION FACILITIES

66-1 General

This work shall consist of furnishing and installing potable water main pipelines, fittings, water services, fire hydrants, valves, valve and meter boxes, blow-offs, water sampling stations, and all appurtenances, including excavation and backfill, disinfection, and pressure testing, all at the locations and in the sizes shown on the Plans. All work shall be done in accordance with the Plans, the Standard Drawings, the Specifications, and as directed by the Engineer.

66-2 Materials

All materials used in constructing potable water facilities shall be new, and shall conform to these Standard Specifications, unless otherwise specified in the Contract Specifications or shown on the Plans. Pipe for water mains 12 inches and less in diameter may be either polyvinyl chloride (PVC) pipe or ductile iron (DI) pipe, at the Contractor's option, except where the specified minimum depth of cover is not achieved. Unless otherwise specified in the Contract Specifications or shown on the Plans, where a minimum depth of cover of 4 feet is not achieved, pipe for water mains 12 inches and less in diameter shall be DI pipe. Pipe for water mains larger than 12 inches in diameter shall be DI pipe, or where designated in the Plans or Contract Specifications, PVC pipe conforming to ASTM Designation C905.

66-2.1 PVC Pipe And Fittings For Water Mains

PVC pipe for water mains in sizes from 4 inches through 12 inches in diameter shall be Class 150 High Pressure Water Pipe conforming to the requirements of AWWA C900, the latest edition of ASTM Specification Designation D 1784, and wall thickness meeting the requirements of DR18. Where Special Pipe is shown on the Plans or specified in the Contract Specifications, special pipe shall be Class 200 and wall thickness to meet requirements of DR 14.

Pipe joints shall be integral bell and spigot gasketed joints conforming to the requirements of ASTM D 3139, with a solid cross section elastomeric seal (gasket) conforming to the requirements of ASTM F 477. The bell section shall consist of an integral wall section and shall be at least as strong as the pipe wall.

Pipe shall withstand a quick burst test pressure of 755 psi in accordance with ASTM D 1599, applied in 60 to 70 seconds. Pipe shall withstand a drop impact test of 73° F at impact of a falling 20 lb. missile with a 2" radius nose according to ASTM D 2444.

The pipe shall be manufactured with standard cast iron pipe outside diameters, and the nominal laying length shall be 20 feet for all sizes. PVC pipe for water mains shall be blue in color, and clearly labeled with the following information:

Manufacturer's name or trademark	Legend: Class, Potable Water
Nominal pipe size	ASTM Designation

Unless otherwise shown on the Plans or specified in the Contract Specifications, pipe fittings for PVC pipe for water mains pipe shall be ductile iron, conforming to the requirements of AWWA C110 for Class 350, and Section 66-2.2, "Ductile Iron Pipe and Fittings for Water Mains," of these Specifications.

Pipe and fittings must be assembled with a nontoxic lubricant.

66-2.2 Ductile Iron Pipe And Fittings For Water Mains

Ductile iron (DI) potable water main pipe shall conform to the requirements of AWWA C150 for Pressure Class 150 or higher, or Special Thickness Class 50 or higher, unless a higher class designation is shown on the Plans or specified in the Contract Specifications. Each pipe shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture.

No field welding of DI pipe is permitted, unless specifically directed or approved otherwise in writing by the Engineer. All welding of DI pipe for welded outlets, or other DI pipe features for which welding is shown on the Plans or specified in the Contract Specifications, shall be shop welding done by the pipe manufacturer.

Pipe shall have standard asphaltic coating on the exterior. Pipe shall also have a cement mortar lining on the interior in accordance with AWWA/ANSI C104/A21.4, or latest revision. DI pipe for water mains shall have a blue, 8-mil polyethylene wrap conforming to the provisions in AWWA/ANSI C105/A21.5. The polyethylene wrap shall be marked with the words "POTABLE WATER", or approved equivalent, arranged in two continuous lines of text, each on opposite sides of the polyethylene wrap. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "ductile" shall be cast or stamped on the pipe.

Except as provided below, all pipe shall be furnished with Push-on Type Joints, such as "Tyton" or "Fastite." Joints shall be in accordance with AWWA/ANSI C111/A21.11, of latest revision, and be furnished complete with all necessary accessories.

Pipe fittings shall be ductile iron, conforming to the requirements of AWWA C110, Class 350 for pipe diameters 24 inches or less, and Class 250 for pipe diameters greater than 24 inches. Fittings shall have a standard asphaltic coating on the exterior. Fittings shall also have a cement mortar lining on the interior in accordance with AWWA/ANSI C104/A21.4, of latest revision.

Fittings for DI water mains larger than 12 inches in diameter shall be restrained joint fittings. Where required, pipe joints adjacent to restrained joint fittings shall be restrained pipe joints. The length of pipe for which joint restraint is required adjacent to restrained joint fittings shall conform to the details shown on the Plans. Thrust blocks shall not be used for DI water mains larger than 12 inches in diameter, unless otherwise directed or approved by the Engineer.

66-2.3 Thrust Blocks

Unless otherwise specified in the Plans or Contract Specifications, concrete for thrust blocks shall be Class 1, 2, 3, or 4 conforming to Section 90, "Portland Cement Concrete," of the State Standard Specifications.

66-2.4 Water Services

Materials for Water services shall conform to the applicable details shown on the Standard Drawings therefor and the provisions in these Standard Specifications. Water service fittings shall be "no-lead" compliant, brass.

66-2.5 Gate Valves

Gate valves shall conform to the details shown on the Plans and Standard Drawings therefor, and to the requirements of AWWA Standard C-509 Valves shall be manufactured by Mueller Co. or City approved equal, with iron body, bronze mounted, double disc, non-rising stem with one "O" ring seal above and below the thrust collar, nut operated, and turning left (counterclockwise) to open, right (clockwise) to close.

Valves shall be manufactured to be compatibly jointed with the water pipe or fittings being valved as shown on the Plans or specified in the Contract Specifications. Reference is made to the applicable Standard Drawings therefor for flanged connection requirements.

Buried valves shall be provided with valve wells per the Standard Drawing to allow access to the valve operator. Valve wells shall be constructed of 8-inch diameter PVC water main pipe. Where the valve operator is deeper than 4 feet below future grade, a valve stem extension shall be provided. Valve stem extensions shall be hot dipped galvanized square steel tubing, shall securely "fit-up" to the operating nut on the valve and shall have a nominal 2-inch nut at the top of the extension. Centering discs near the top and bottom of the extension shall be provided. Valve stem extensions shall be extended to within 12 to 18 inches of finished grade.

Valves at hydrant and/or wet tap locations shall be flanged on one side to directly connect to the tee on the main supply side of the valve, as shown on the Standard Drawings. For DI water mains larger than 12 inches in diameter, the Contractor shall construct valve foundations conforming to the details shown on the Plans and Standard Drawings.

66-2.6 Butterfly Valves

This work shall consist of furnishing all materials and installing butterfly valves, as shown on the Plans, as specified in the Specifications, and as directed by the Engineer.

Butterfly valves and the materials used in their manufacture shall conform to the provisions in the most recent revisions of AWWA C504 and NSF/ANSI Standard 61, and these specifications.

The design pressure class for butterfly valves shall be class 150B.

Butterfly valves shall be Groundhog butterfly valves as manufactured by Henry Pratt, Line Seal butterfly valves as manufactured by the Mueller Company, or approved equal. The valve manufacturer shall have 10 years experience manufacturing butterfly valves. The valve manufacturer's name, year of manufacture, valve size, model number and rated design pressure shall be cast on the body of each valve.

The operating direction to open shall be left (counterclockwise) and to close shall be right (clockwise). The direction to open shall be cast on the operating nut or hand-wheel.

Butterfly valves shall be of the tight closing, rubber seat type suitable for underground installation, as shown on the Plans. Valves shall have a full uninterrupted 360 degree sealing surface and shall shut off completely at the rated design pressure in either direction of flow. Valves shall be suitable for very infrequent operation after extended periods of inactivity.

All valves and actuators shall be specially designed for service below grade where groundwater may completely submerge the valve and operator nut.

Valves shall be short body and shall be constructed of cast iron conforming to the provisions in ASTM A126 for Class B, or ductile iron conforming to the provisions in ASTM A536, for Grade 65-45-12 or Grade 70-50-05.

Flanged end valves shall be faced and drilled as specified in ANSI B16.1 for Class 125, unless otherwise shown on the Plans.

Seats shall be Buna-N rubber body seats of one-piece construction molded, bonded or retained in a machined cavity in the valve body. Seats may not be located on the disc, and may not be mechanically retained by segments and or screws.

Shafts and disc shaft fasteners for butterfly valves rated at 150 psi shall be constructed of Type 304 or Type 316 stainless steel.

Valve packing shall be of the self-adjusting Chevron type. The valve shall be fitted with sleeve bearings that are corrosion resistant and self-lubricated.

Discs for butterfly valves shall be rated at 150 psi and shall be ductile iron conforming to the provisions in ASTM A536 for Grade 65-45-12 or Grade 70-50-05, or cast iron conforming to the provisions in ASTM A48 for Class 40, or cast iron conforming to the provisions in ASTM A126 for Class B. The valve disc shall be secured to the shaft by means of solid, smooth sided, stainless steel or Monel taper pins or dowel pins having a circular cross section. Each taper or dowel pin shall extend through the shaft and shall be mechanically secured in place. The use of bolts, setscrews, knurled or fluted dowel pins, expansion pins, roll pins, tension pins, spring pins, torque plugs or other devices in lieu of the specified pins will not be allowed.

Butterfly valve discs shall have a continuous stainless steel edge welded or applied to the disc as specified in AWWA C504. The twin-wire arc method for applying the stainless steel edge to the disc is not allowed.

Manual actuators shall be worm gear or traveling nut style that must be within 4 turns of having at least 2 turns per diameter inch of the valve size to rotate the disc 90 degrees. Actuators shall be of totally enclosed, self-locking worm gear or traveling nut type with adjustable stops, factory set, to limit disc travel. Actuator cases shall be designed for installation and operating in a buried or submerged location and shall be fully gasketed, sealed and grease packed. Actuators shall be capable of withstanding and external water pressure of 10 psi without leakage to the interior of the operator. Actuators shall be sized to produce a torque of 1.5 times the required valve torque. The required valve torque shall be based on the rated pressure at 16 feet per second and 150 psi differential pressure using the method described in the Appendix to AWWA C504. Stop limiting devices must withstand 450 ft-lbs. of input torque against the open and closed stops without failure. Test reports and proof-of-design for the actuator may be required to be submitted for design of stop limiting devices and internal components.

All interior and exterior ferrous surfaces shall be factory coated with two or more coats of 2-part epoxy coating to a minimum dry film thickness of 12 mils.

Butterfly valve installation shall conform to the details shown on the Plans, and the applicable details shown on the Standard Drawing for valve installation. For water mains, the valve box shall conform to the details shown on the Standard Drawing therefor.

66-2.7 Valve Boxes

Each valve shall be provided with a valve box in conformance with the applicable Standard Drawing therefor. Valve boxes shall be precast concrete with heavy cast iron ring seating a deeply ribbed cast iron cover providing an 8-inch diameter clear opening, and shall be Christy No. G5 traffic box, or approved equal. Cover marking shall read "Water". A one-piece 8-inch inside diameter PVC riser extension shall be provided to allow unobstructed access to the valve-operating nut.

66-2.8 Fire Hydrants And Fire Services

Fire hydrants and Fire Services shall be furnished as indicated on the Standard Drawing pertaining thereto. Fire Hydrants shall be of the wet barrel type, with each outlet operated by an independent valve. The inlet to the hydrant shall be 6 inches formed to connect to the feeder pipe. Hydrants shall be provided with break-off fittings and with 30 inch bury and extensions as necessary.

66-2.9 Copper Tubing

All copper tubing shall conform to the latest revision of ASTM Specification Designation B 88 as latest amended. The tubing shall be made of copper having a purity of at least 99.9 percent as determined by electrolytic assay, except that silver may be counted as copper. Copper tubing shall be seamless, shall be of one grade, designated type "K," soft, as listed in the above specifications. The tubes shall be clean, smooth, round, of proper dimension, free from grooving, indentations, cracks, flaws and scale and shall not crack when flaring.

The name or trademark of the manufacturer and a symbol indicative of the type shall be permanently marked at intervals not greater than 20 inches on the tubing.

66-2.10 Other Service Material

All service material shall be as indicated on the Plans, Standard Drawings, or as specified in the Contract Specifications.

66-2.11 Nuts, Bolts, Screws and Fasteners

All nuts, bolts, screws and fasteners used for connecting flanges, valve body parts, etc., below the ground surface shall be manufactured of nickel-cadmium steel, or approved equal (equipment within valve boxes is considered below ground). Nuts and bolts used for above ground installation on pipe flanges, etc., shall be hexagonal head machine bolts and hexagonal nuts conforming to ASTM Designation A307, Grade B. All bolt threads shall be lubricated with graphite and oil. Exposed portions of nuts and bolts shall be coated with a bitumastic material to retard corrosion.

66-2.12 Tracer Wire

Tracer wire shall be #10 stranded copper, with white insulation.

66-3 Trenching And Excavation

Trenching and excavating for water mains and service lines shall conform to the requirements of Section 8-15, “Utility and Non-Street Facilities; Potholing,” and Section 19-3, “Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration.”

66-4 Alignment Changes (Separation Criteria)

All potable water mains, and non-potable water mains which include sanitary sewers, sewer force mains, storm drains, and recycled water mains, must meet the separation standards of the "California Waterworks Standards", contained in Section 64572, Title 22, of the California Administrative Code, or shall be installed in accordance with alternate construction criteria as specified therein. Included in the Appendix to these Specifications is a document titled “Guidance Memo No. 2003-02: Guidance Criteria for the Separation of Water Mains and Non-Potable Pipelines” published by the California Department of Health implementing said Section 64572. This document sets forth minimum spacing requirements between drinking water pipelines and sewer or reclaimed water pipelines, and has been used to set the location of the water main. In the event that field conditions require a change in the planned alignment (horizontal or vertical) of the water main, under no circumstances shall a change be made without obtaining the express and written approval of both the City inspector and the City Design Engineer. Any change so authorized must comply with the Guidance Memo.

66-5 Installation Of Water Mains, Fittings, And Valves

Potable water mains, fittings, valves, and all appurtenances shall be furnished and installed as shown on the Plans, in conformance with the Specifications, the Standard Drawings, and as directed by the Engineer. Water mains shall be installed true to the alignment and profile shown on the Plans. Occasional minor variations of two inches or less from the alignment shown on the Plans, and one

inch or less from the profile shown on the Plans, will be permitted, provided that such variations occur gradually, over a distance of 20 feet or more, and are approved by the Engineer.

Where necessary to avoid conflicts with existing utilities, the depth of cover shall be increased or decreased as approved by the Engineer. Such adjustments shall be accomplished by gradual changes in pipe depth whenever possible, utilizing joint deflections not exceeding manufacturer's recommendations. When fittings are required to accomplish such changes in depth of cover, no 90-degree bends may be used unless otherwise directed or approved by the Engineer. Any changes in the planned alignment, horizontal or vertical, shall be made in strict accordance with Section 66-4, "Alignment Changes (Separation Criteria)." Unless required otherwise by specific pipe elevations, cover, or clearance depths shown or not shown on the Plans, water mains shall be installed with a minimum depth of cover of 48 inches.

As installation progresses, all pipe, valves, fittings, hydrants, etc., shall be thoroughly cleaned of all dirt, rocks and other debris that may be found in the interior of the material. The Engineer may direct the Contractor to swab the pipe to clean it. At the end of each day's work, all ends of the pipe shall be closed by means of a pre-manufactured cap or special bulkhead or by other means approved by the Engineer.

Water pipe and fittings shall be installed in compliance with the manufacturer's recommendations, with each length of pipe having an even bearing on a properly prepared trench bottom for its entire length, with depressions cut for couplings, bells and fittings. Optional alternate methods of supporting the pipe slightly above the bottom of the trench on earth mounds may be implemented by the Contractor if approved by the pipe manufacturer and the procedures are carried out in strict compliance with his instructions. Use of blocks to support pipe or fittings is prohibited. Valves and fire hydrants shall be installed as indicated on the Standard Drawings and as directed by the Engineer. Hydrants shall be installed plumb, with steamer outlet facing the curb.

Pipe may be cut by methods approved by CAL-OSHA that will produce a square cut. No wedge type roller cutters will be allowed. PVC or DI pipe, machined overall, in lengths shorter than 3 feet may be used to make connections where approved by the Engineer. Such pipe shall conform to Section 66-2, "Materials," of these Specifications.

Rubber gasketed joints shall be made in compliance with the manufacturer's recommendations and as follows:

1. The gasket seat in the socket and the gasket shall be wiped clean with a cloth. The gasket shall be placed in the socket with the large end entering first. It shall then be sprung into the gasket seat so that the groove fits over the head in the seat. A thin film of lubricant shall then be applied to the inside surface of the gasket that will come in contact with the entering pipe.

2. The plain end of the pipe to be entered shall be wiped clean and placed in proper alignment with the bell of the pipe to which it is to be joined. In some cases it may be desirable to apply a thin film of lubricant to the outside of the plain end.

3. The joint shall then be made by exerting sufficient force on the entering pipe (by methods approved by the Engineer) so that its plain end is moved past the gasket until it makes contact with the base of the socket and has been shoved "home". Allowance shall be provided, in making the joint, for expansion of the pipe.

4. Whenever necessary to deflect the pipe from a straight line either in vertical or horizontal plane to avoid obstructions, or where long radius curves are permitted, the degree of deflection of joints shall not exceed the manufacturer's recommendations and must be approved by the Engineer.

Wet tap connections shall be made at the locations shown on the Plans and in conformance with the applicable City Standard Drawings.

Disinfection of pipe for potable water mains shall conform to the provisions of Section 66-11, "Sterilization of Water Facilities."

Hydrostatic testing shall conform to the provisions in Section 66-12, "Hydrostatic Pressure Test."

Damage to any pipe, fittings, valves, or appurtenances shall be grounds for rejection of the damaged material. Any repairable damage to the pipe, lining or fittings shall be repaired by the Contractor at his expense. The Contractor shall be responsible for any damage to materials until the time of acceptance of the finished work.

66-6 Tracer Wire Installation

A tracer wire shall be installed with all pipe for potable water mains The wire shall be secured in an approved manner to the outside top center of the pipe to prevent movement during backfill operations. The tracer wire from each direction of the pipe shall extend up into each valve or blowoff box, with an excess of 4 feet of wire coiled and attached to the inside of the box in a manner that allows easy access to the wires. The wires shall be tagged "Tracer Wire" with a waterproof label. Ends of wire shall not be attached to each other or grounded.

66-7 Thrust Blocks

Thrust blocks shall not be used for DI water mains larger than 12 inches in diameter, unless otherwise directed or approved by the Engineer. Thrust blocks shall be constructed at all fittings and valves for PVC water mains as required by these Standard Specifications, and as shown on the applicable Standard Drawing. Thrust blocks shall be constructed at all fittings and valves for DI water mains 12 inches in diameter and smaller, in conformance with the provisions in these Standard Specifications, and as shown on the applicable Standard Drawings. In lieu of thrust blocks at fittings, restrained joint fittings and restrained pipe joints may be used with the prior written approval of the Engineer. For DI water mains 12 inches in diameter and smaller, thrust blocks shall be constructed at all valves, in conformance with the provisions in these specifications, and as shown on the applicable Standard Drawing.

Concrete thrust blocks shall be provided on water mains at all points in the line where a change in direction of more than 5 degrees occurs, at all gate valves 10 inches or larger, at all fire hydrant buries and at all dead ends. Thrust blocks shall be installed between the fittings and undisturbed earth of the trench wall and shall be at least the minimum dimensions shown on the Standard Drawings. For conditions not covered on said standard, the bearing area shall be as required by the Engineer.

66-8 Valve Box Installation

Valve boxes shall be installed as shown on the Standard Drawings therefor. The valve box cover shall be centered over the valve operating nut, with boxes and extensions plumb.

In existing surfaced areas, valve boxes shall be installed to finish grade, concrete collars poured and the pavement patched in accordance with Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration." In undeveloped areas where no surfacing exists or is

contemplated in conjunction with the water installation, valve boxes shall be brought to a level 1-1/2 inches above existing ground elevation and concrete collars poured. In areas where street or alley surfacing is to be done in conjunction with or immediately after utility installation, such as new subdivisions, valve boxes shall be installed to finish grade after paving has been completed, a concrete collar poured, and the pavement patched as above required. Unless specifically provided otherwise in the Contract Specifications, the Contractor shall return and install the valve box to finish grade as specified.

66-9 Water Service Installation

Water service lines (including domestic metered service lines and fire service lines), equipment and appurtenances shall be installed in accordance with the manufacturer's recommendations, as shown on the Plans and the Standard Drawings therefor. The Contractor shall mark the location of water service lines by putting a "W" mark on the curb face. Said mark is to be chiseled into existing concrete or stamped in new concrete before it has set.

66-10 Backfill, Compaction, And Surface Restoration

Backfilling, compacting and restoration of surfaces of trenches and excavations for water facilities shall conform to the requirements of Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration."

66-11 Sterilization Of Water Facilities

Newly installed water mains and facilities shall be disinfected in accordance with the latest revisions of AWWA Standards and these specifications prior to placing in service.

While completely separated from existing mains, and isolated from existing mains and prior to pressure testing and prior to acceptance of work, the entire pipeline including all valves, fittings, hydrants, service laterals, and other accessories shall be sterilized in accordance with AWWA Specification C 601 which provides detail specifications for:

A. Limiting contaminated materials from entering the water mains during construction or repair.

B. Removing, by flushing, contaminating materials that may have entered the water main during construction or repair.

C. Disinfecting any residual contamination that may remain after cleaning.

D. Determining the bacteriologic quality of fresh water in the main after disinfecting the main.

All mains shall be flushed with potable water after completion of construction and prior to disinfecting. The Contractor shall provide a sufficient number of suitable outlets at the end(s) of the line(s) being sterilized in addition to those required by the Plans, to permit the main to be flushed with water at a velocity of at least 5.5 feet per second over its entire length. The outlets provided shall meet the requirements for fittings as specified for the type main constructed. Temporary blow-offs may be installed during the sterilization and flushing to satisfy those requirements. Drainage facilities shall be constructed such that the water lines cannot be contaminated through flushing outlets.

The outlets provided shall meet the requirements for fittings as specified for the type main constructed. Temporary blow-offs may be installed during the sterilization and flushing to satisfy those requirements. Drainage facilities shall be constructed such that the water lines cannot be contaminated through flushing outlets.

After flushing, chlorine gas or chlorine compound solution made with liquid chlorine, calcium hypochlorite in solution or sodium hypochlorite solution shall be water mixed and introduced into the mains to form a chlorine concentration of approximately 100 parts per million (ppm) or that which will provide a minimum residual of 50 ppm in all parts of the line after 24 hours have elapsed. During the sterilization process, all valves, hydrants, and other accessories shall be operated. After chlorination, the water shall be flushed from the line at its extremities until the replacement water tests are equal chemically and bacteriologically to those of the permanent source of supply.

The placing of HTH capsules or tablets in pipe sections during the laying process will be considered as an acceptable method of introducing chlorine for the test.

The chlorine water solutions shall be diluted to a chlorine concentration of not more than 100 ppm and not less than 50 ppm measured in the water lines. The Contractor shall keep adequate chlorine residual testing and indicating apparatus available on the site during the entire sterilization period.

After final flushing, the flushing fittings shall be plugged with devices intended for this purpose, at the pressure class of the pipe. Where water main is coated, plugs and outlets shall be similarly coated.

Bacteriologic samples of water for the specified bacteriologic test shall be taken from each end of the sterilized main (located downstream of the point of introduction of chlorine disinfectant), and at other locations as determined necessary by the Engineer. When an entire water main is to be tested, it shall be completely isolated from the existing system. Bacteriologic samples shall be taken a minimum of 48 hours after the mains have been flushed of all chlorine. Such samples shall be obtained by the Contractor using pipe and fittings supplied by the Contractor as directed by the Engineer. Bacteriologic samples shall be obtained in the following manner:

At corporation stops, risers shall be installed that will discharge water directly downward towards the ground. The discharge point of the risers shall be a minimum of 24 inches above the ground. Risers shall include the necessary bends to accomplish the foregoing, and shall be equipped with in-line valves near the discharge points to regulate the flow. The Contractor shall provide and supply these hookups, full compensation therefor to be included in the amount bid for the various water main bid items.

For mains over 1,320 feet in length with no services, samples in addition to those obtained at each end shall be taken at intermediate points in such a manner that at least one sample is taken for each 660 feet of main.

The recommended procedure of sterilizing and testing water mains is as follows:

1. Chlorine residual of between 50 and 100 ppm is introduced into the water mains.

2. 24 hours later, treated water is flushed from the water mains.

3. 48 hours after flushing, water samples are taken for bacteriologic tests.

4. 96 hours after samples are taken, results of water samples are reported to the Contractor.

5. If the bacteriologic tests show a coliform M.P.N./100 ML water of less than 1.1 on all samples, the water facilities tested will be considered clear. In the event the coliform number

is 1.1 or above, the sterilization procedure shall be commenced again within 24 hours of notice by the City that the bacteriologic tests failed.

Should the end of any of the foregoing periods fall on a City nonworking day, the order of procedure will be continued to the next regular City working day.

The Contractor shall provide all water necessary for disinfection, in conformance with the provisions in Section 17, "Water Use." The Contractor shall make all arrangements and pay all fees necessary for the lawful disposal of water discharged during disinfection and hydrostatic testing operations. Potential recipients with which the Contractor may wish to negotiate arrangements for the disposal of water include, but are not necessarily limited to, private property owners, Fresno Irrigation District (FID), and Fresno Metropolitan Flood Control District (FMFCD). Water so discharged may be used by the Contractor for construction purposes, with the prior written approval of the Engineer.

66-12 Hydrostatic Pressure Test

After the water pipe and all appurtenances have been laid, backfill has been placed and compacted and all compaction tests have passed and the pipe has passed the bacteriologic disinfection test, but prior to placement of aggregate base or pavement material, a hydrostatic pressure test shall be conducted on the entire pipeline, while completely isolated from any existing water mains, for a period of one hour at a hydrostatic pressure of 100 psi. All valves in the pipeline shall be in the open position during system testing. Any leaks, failures, or imperfect construction revealed by such test shall be promptly corrected by the Contractor and retested until all visible leakage has been stopped and test results do not exceed the allowable leakage which shall be determined by the following equation:

$$L = \frac{N \times D \times \sqrt{P}}{7{,}400}$$

where: L = allowable leakage (gal/hr)
N = number of joints in the tested line
D = nominal inside diameter of pipe (inches)
P = average test pressure (psi)

The Contractor shall provide all water necessary for hydrostatic testing, in conformance with the provisions in Section 17, "Water Use." The Contractor shall make all arrangements and pay all fees necessary for the lawful disposal of water discharged during hydrostatic testing operations. Potential recipients with which the Contractor may wish to negotiate arrangements for the disposal of water include, but are not necessarily limited to, private property owners, Fresno Irrigation District (FID), and Fresno Metropolitan Flood Control District (FMFCD). Water so discharged may be used by the Contractor for construction purposes, with the prior written approval of the Engineer.

The length of water main which has not passed hydrostatic testing, at any specific time during the work, shall not be more than 1,400 lineal feet, unless specifically directed or allowed otherwise by the Engineer in writing. The Contractor shall provide additional lengths of restrained pipe, and/or other measures and facilities, as necessary to comply with this requirement.

Tests shall not be made until at least 36 hours after the last concrete thrust or reaction blocking shall have been cast with high early strength cement, or at least 7 days after the last concrete thrust or

reaction blocking shall have been cast with standard cement. All equipment, testing and repair shall be furnished by the Contractor.

66-13 Measurement

Measurement for water main installation and fitting installation shall be by the lineal foot of pipe installed, and shall be the actual horizontal length installed, measured through fittings.

Measurement for gate and butterfly valves shall be per each valve installed.

Measurement for fire hydrants, complete, shall be per each fire hydrant assembly installed.

Measurement for water service lines shall be per each water service line installed.

Measurement for fire service lines shall be per each fire service line installed.

66-14 Payment

The unit price bid per lineal foot for water mains shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include furnishing and installing the pipe and fittings, installing concrete thrust blocks, trenching, backfilling, compacting, sterilization, hydrostatic pressure testing, water, and all incidentals.

The unit price bid per each for gate or butterfly valves shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include furnishing and installing the valve, valve box, and valve extension, installing concrete thrust blocks, trenching, backfilling, compacting, testing, sterilization, pressure testing, water, returning and installing valve box to final grade following trench surface restoration, street or alley construction or reconstruction, and all incidentals.

The unit price bid per each for fire hydrants, complete, shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include furnishing and installing the hydrant assembly (pipe, fittings, structures, break-off fittings, bury, extensions, gate valve and valve box), furnishing and installing protection posts where required, excavation, backfill and compaction, returning and adjusting valve box to final grade following trench surface restoration, street or alley construction or reconstruction, testing, sterilization, water, and all incidentals. Unless otherwise indicated in the Contract Specifications, the cost of furnishing and installing any wet tap required for the hydrant shall be included in the unit price bid for fire hydrants, complete.

The unit price bid per each for water service lines shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include furnishing and installing the service pipe and appurtenances (including all taps, fittings, stops, saddles, spacers, meter box and lid, etc.), trenching, backfilling, compacting, testing, sterilization, water, adjusting meter box to finish sidewalk grade, and all incidentals.

The unit price bid per each for fire service lines, complete, shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This

shall include furnishing and installing the fire service pipe, fittings, structures, gate valve and valve box, thrust blocks, connection to main pipe, and all excavation, backfill and compaction, returning and adjusting valve box to final grade following trench surface restoration, street or alley construction or reconstruction, testing, sterilization, and all incidentals. Unless otherwise indicated in the Contract Specifications, the cost of furnishing and installing any wet tap required for the fire service line shall be included in the unit price bid for fire service lines, complete.

Payment for wet taps, except those directly associated with fire hydrants or fire service installations, shall be as set forth in the Contract Specifications.

SECTION 67 - RECYCLED WATER DISTRIBUTION SYSTEMS

67-1 General

This work shall consist of furnishing all materials and constructing recycled water mains, as shown on the Plans and Standard Drawings, as specified in the Specifications, as referenced in the City of Clovis Public Utilities Department's *Rules and Regulations Governing the Distribution and Use of Recycled Water* dated November 3, 2011 and any revisions made and adopted thereafter, and as directed by the Engineer. Recycled water mains shall conform to the provisions in Section 66, "Potable Water Distribution Facilities," except as may be specified in this Section 67.

67-2 Materials

All materials used in constructing recycled water facilities shall be new, and shall conform to these Standard Specifications, unless otherwise specified in the Contract Specifications or shown on the Plans. Pipe for recycled water mains 12 inches and less in diameter may be either polyvinyl chloride (PVC) pipe or ductile iron (DI) pipe, at the Contractor's option, except where the specified minimum depth of cover is not achieved. Where the specified minimum depth of cover is not achieved, pipe for recycled water mains 12 inches and less in diameter shall be ductile iron (DI) pipe.

Pipe for recycled water mains larger than 12 inches in diameter shall be ductile iron (DI) pipe, or where shown on the Plans or specified in the Contract Specifications, PVC pipe conforming to ASTM Designation C905.

New buried Recycled Water piping (mains and laterals) shall be of purple-colored pipe with the continuous wording "RECYCLED WATER – DO NOT DRINK" printed on opposite sides of the pipe. The pipe must be laid with the wording facing upwards. An acceptable alternative is to identify all new buried Recycled Water lines with continuous lettering on three-inch (3") minimum width, purple marking tape with one-inch black or white contrasting lettering bearing the continuous wording "RECYCLED WATER – DO NOT DRINK." This tape must run continuously on top of all piping and must be attached to piping with plastic tape banded around the marking tape and the pipe every five feet on center. Marking tape must extend to all valve boxes and/or vaults and exposed piping.

67-2.1 PVC Pipe And Fittings For Recycled Water Mains

PVC pipe and fittings for recycled water mains shall conform to the provisions in Section 66-2.1, "PVC Pipe and Fittings for Water Mains," except as specified in this Section 67-2.1.

PVC pipe for recycled water mains shall be purple in color, (Pantone Color #512) and shall be factory marked with the words "CAUTION: NONPOTABLE WATER – DO NOT DRINK" in black letters, arranged in a continuous line of text on both sides and for the full length of the pipe.

67-2.2 Ductile Iron Pipe And Fittings For Recycled Water Mains

Ductile iron (DI) pipe and fittings for recycled water mains shall conform to the provisions in Section 66-2.2, "Ductile Iron Pipe and Fittings for Water Mains," except as specified in this Section 67-2.2.

DI pipe for recycled water mains shall be installed with a purple, 8-mil, 3-inch wide minimum, polyethylene wrap conforming to the provisions in AWWA/ANSI C105/A21.5. The polyethylene wrap shall be marked with the words "CAUTION: NONPOTABLE WATER – DO NOT DRINK", or approved equivalent, arranged in two continuous lines of text, each on opposite sides the polyethylene wrap and for the full length of the pipe.

67-2.3 Thrust Blocks, Valves, Valve Boxes
Thrust Blocks, Valves, and Valve Boxes shall conform to the applicable sections in Section 66, "Potable Water Distribution Facilities," and the following provisions.

The valve operator, or valve extension for deep valves, shall be marked with a purple weatherproof tag containing the words "Recycled Water- Do Not Drink" in black letters. Valve boxes and lids shall be Christy Type G-4, with the words "Recycled Water" stamped in prominent letters on top of the lid.

67-2.4 Recycled Water Services
Materials for recycled water services shall conform to the applicable details shown on the Plans, the Standard Drawings, and the Specifications. Recycled water services shall not have concrete collars.

67-2.5 Nuts, Bolts, Screws, Fasteners, Other Service Materials
Nuts, Bolts, Screws, Fasteners, and Other Service Materials shall conform to the applicable sections in Section 66, "Potable Water Distribution Facilities."

67-2.6 Tracer Wire
Tracer wire shall conform to Section 66-2.12, "Tracer Wire."

67-3 Trenching, Excavation, Backfill, Compaction, And Surface Restoration
Trenching and other excavating, backfill, compaction, and surface restoration for recycled water mains and services shall conform to the requirements of Section 8-15, Utilities and Non-Street Facilities; Potholing," and Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration."

67-4 Alignment Changes (Separation Criteria)
All alignment changes, horizontal or vertical, shall conform to the provisions of Section 66-4, "Alignment Changes (Separation Criteria)."

67-5 Installation Of Recycled Water Mains, Fittings And Valves
Installation of Recycled Water Mains, Fittings and Valves shall conform to the provisions of Section 66-5, "Installation of Water Mains, Fittings and Valves," and the following provisions. Unless required otherwise by specific pipe elevations or cover or clearance depths shown on the Plans, recycled water mains shall be installed with a minimum depth of cover as shown in the following table. Where necessary to avoid conflicts with existing utilities, the depth of cover shall be increased as required. Such adjustments shall be accomplished by gradual changes in pipe depth whenever possible, utilizing joint deflections not exceeding manufacturer's recommendations. When fittings are required to accomplish such changes in depth of cover, no 90-degree bends may be used, unless otherwise directed or approved by the Engineer.

Pipe Diameter	Minimum Depth of Cover
6" or Smaller	36"
8" and 10"	42"
12"	48"
14" and 16"	54"
18" or Larger	60"

Recycled water mains shall be installed true to the alignment and profile shown on the Plans. Occasional variations of two inches or less from the alignment shown on the Plans, and one inch or less from the profile shown on the Plans, will be permitted, provided that such variations occur gradually, over a distance of 20 feet or more, in the opinion of the Engineer. Reference is made to Section 67-4, "Alignment Changes (Separation Criteria)."

Where proposed recycled water mains are to be connected to existing recycled water mains, the existing recycled water mains may or may not be in service or under pressure. The Contractor shall contact the Engineer to determine the status before attempting any connections. Existing recycled water mains can be expected, as a minimum, to be filled with water. The Contractor shall dewater existing recycled water mains as necessary to facilitate the connection of proposed recycled water mains.

Pipe shall be installed with the wording "RECYCLED WATER-DO NOT DRINK" facing upwards.

A tracer wire shall be installed with all recycled water mains, in conformance with the applicable provisions in Section 66, "Potable Water Distribution Facilities," of these Specifications.

Sterilization of recycled water mains is not required.

67-6 Tracer Wire Installation

A tracer wire shall be installed with all pipe for recycled water mains. Materials and installation shall conform to Sections 66-2.12, "Tracer Wire," and 66-6, "Tracer Wire Installation."

67-7 Thrust Block, Valve Box Installation

Thrust Blocks and Valve Boxes shall be installed in accordance with Section 66-7, "Thrust Blocks," and 66-8, "Valve Box Installation."

67-8 Water Service Installation

Recycled water service lines (including metered service lines where required), equipment and appurtenances shall be installed in accordance with the manufacturer's recommendations, as shown on the Plans and the Standard Drawings therefor. The Contractor shall mark the location of recycled water service lines by putting a "RW" mark on the curb face. Said mark is to be chiseled into existing concrete or stamped in new concrete before it has set.

67-9 Hydrostatic Pressure Test

Hydrostatic pressure testing shall be performed in accordance with Section 66-12, "Hydrostatic Pressure Test."

67-10 Measurement

Measurement for recycled water main installation and fitting installation shall be by the lineal foot of pipe installed, and shall be the actual horizontal length installed, measured through fittings.

Measurement for gate, butterfly, or other valves shall be per each valve installed.

Measurement for recycled water service lines shall be per each water service line installed.

67-11 Payment

The unit price paid per lineal foot for recycled water mains shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This

shall include furnishing and installing the pipe and fittings, installing concrete thrust blocks, trenching, backfilling, compacting, hydrostatic pressure testing, water, and all incidentals.

The unit price paid per each for gate, butterfly, or other valves shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include furnishing and installing the valve, valve box, and valve extension, installing concrete thrust blocks, trenching, backfilling, compacting, testing, sterilization, pressure testing, water, returning and installing valve box to final grade following trench surface restoration, street or alley construction or reconstruction, and all incidentals.

The unit price paid per each for recycled water service lines shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include furnishing and installing the service pipe and appurtenances (including all taps, fittings, stops, saddles, spacers, meter box and lid, if required), trenching, backfilling, compacting, testing, adjusting meter box (if required) to finish sidewalk grade, and all incidentals.

SECTION 68 - JACKING PIPE

68-1 General

This work shall consist of furnishing, boring, and jacking into place at the locations and type of pipe shown on the Plans or specified in the Contract Specifications, in accordance with these Standard Specifications and Standard Drawings, and as directed by the Engineer.

Reinforced concrete pipe with rubber gasket joints, as a carrier pipe as specified in this Section 68, may be jacked into place directly without a jacked steel casing. All other carrier pipe must be installed within a jacked steel casing.

68-2 Materials

68-2.1 Steel Casing Pipe

Steel casing pipe shall be of the outside diameter (OD) and minimum wall thickness not less that that shown on the Plans and shall be butt welded of sheets conforming to ASTM A-570 commercial grade or of plate conforming to ASTM A-283. If the Contractor's operations require a greater wall thickness for successful installation of the steel casing pipe to line and grade without damage, the Contractor shall provide steel casing pipe of such greater wall thickness at no additional cost to the City.

Steel casing pipe shall be of the size and class (or strength designation) shown on the Plans or specified in the Contract Specifications, except that the class of pipe designated has been determined for vertical loads only. Additional facilities, reinforcement, or strength of pipe required to withstand jacking pressure shall be determined and furnished by the Contractor at his expense.

All field joints also shall be butt welded full circumference or by other means approved by the Engineer. Joints to be field welded shall be shop cut to ensure a true 90° to the longitudinal axis of the pipe. Use of a jacking band to reinforce the end of the pipe receiving the jacking thrust will be required. It shall be the Contractor's responsibility to provide joints that are capable of resisting the jacking stresses without failure.

68-2.2 Casing Spacers

Casing spacers shall be prefabricated stainless steel, and shall be as designed and manufactured by Pipeline Seal & Insulator, Inc., Houston, Texas, www.pipelineseal.com (PSI), and shall be PSI Model S8G-2 for carrier pipes up to 24 inches in diameter, and shall be Model S12G-2 for larger carrier pipes, or approved equal. Casing spacers shall be specifically designed and fabricated for the specific project and application for which they are furnished. Casing spacers shall electrically isolate the carrier pipe from the casing.

Casing spacer materials shall also conform to the following requirements:

1. Bands shall be 304 stainless steel, 8 inches wide for carrier pipes up to 24 inches in diameter, and 12 inches wide for larger carrier pipes. Bands shall be two segment, 14-gauge bands for carrier pipes less than 42 inches in diameter, and shall be three or more segment, 12-gauge bands for larger carrier pipes. Bands shall be fitted with a flexible PVC liner on the inner surface of the band. The PVC liner shall have a thickness of 0.09 inch, a hardness of 85-90 (ASTM D2240, Durometer "A"), and a dielectric strength of not less than 58,000 volts (ASTM D149).

2. Risers shall be 304 stainless steel, 10 gauge, designed and fabricated to support the carrier pipe and its liquid load. Risers shall be sized to position, support and stabilize the carrier pipe in the casing.
3. Runners shall be high pressure molded, glass-reinforced polymer having a compressive strength not less than 18,000 psi. Runners shall be not less than two inches wide, shall be at least 8 inches long for use with an 8 inch casing band, and at least 11 inches long for use with a 12-inch casing band. Runners shall be attached to the band or riser, as applicable for the particular casing spacer design, by 3/8 inch welded 304 stainless steel studs and lock nuts. The studs and locknuts shall be recessed below the wearing surface of the runner so as to provide a clearance of at least ½ inch to the interior surface of the casing pipe in the installed condition, allowing for runner wear during carrier pipe installation. The recess shall be filled with a corrosion inhibiting filler approved by the Engineer.
4. Hardware for joining band sections shall be 304 stainless steel studs, locknuts and washers. Hardware shall be 5/16 inch for carrier pipes up to 42 inch diameter and 3/8 inch for carrier pipes 42 inch and larger.

The casing spacer manufacturer shall have implemented a quality management system, and shall hold a current certificate of registration, issued by a certifying organization acceptable to the Engineer, certifying that the quality management system conforms to the provisions of ISO 9001:2000 and is applicable to the manufacturing of casing spacers. A copy of the certificate of registration shall be submitted to the Engineer.

68-2.3 Casing End Seals

Casing end seals shall be PSI Model "C", or Model "S", as manufactured by Pipeline Seal and Insulator, Inc., Houston, TX, or approved equal. Concrete plugs shall not be used for casing end seals unless otherwise shown on the plans or specified in the Contract Specifications. In such cases, concrete shall be Class 2 conforming with Section 90, "Portland Cement Concrete," of the State Standard Specifications.

68-2.4 Reinforced Concrete Pipe

Where reinforced concrete pipe, as a carrier pipe, is specified to be jacked into place directly without a jacked steel casing, said reinforced concrete pipe conforming to ASTM Specification C76, latest revision, shall be furnished. The reinforced concrete pipe shall be constructed such that no bells protrude from the outside periphery of the pipe. Sleeves for joints on reinforced concrete pipe shall be furnished and manufactured of galvanized steel, stainless steel, or fiberglass, sufficient in strength to withstand all loads, and which will maintain a rubber-gasketed watertight joint.

68-3 Tunnel Safety Orders

Reference is made to the Tunnel Safety Orders of the California Department of Industrial Relations, and to any other applicable safety codes. The tunnel site (jacking location) will be classified as to gas hazard by the California Department of Industrial Relations. The classification document issued by the State will be included in the Appendix of the Contract Specifications. The Contractor shall comply with the Tunnel Safety Orders, and shall attend a preconstruction safety meeting with a representative of the Division of Occupational Safety and Health, Mining and Tunneling Unit, wherein the Contractor shall present his safety program. Any subcontractors involved in such tunneling shall likewise be present. The Contractor shall contact the California Department of Industrial Relations, Division of Occupational Safety and Health. Reference is made to Section 19-3.02, "Trench and Structure Excavation," of these Specifications for additional safety requirements.

68-4 Excavating Jacking And Receiving Pits

Before starting excavation, the Contractor shall submit drawings or details of jacking pit bracing, casing pipe, jacking equipment, skids or concrete support blocks, bracing to prevent pipe shifting or flotation, and all other equipment or methods to be used.

Excavation for jacking and receiving pits shall conform to the provisions in Section 8-15, Utility and Non-Street Facilities; Potholing," Section 19-3.02, "Trench and Structure Excavation," and to the following provisions.

Jacking and receiving pits shall not extend beyond vertical planes passing through the jacking and receiving pit limits shown on the Plans, and shall be sheathed, shored, sloped or braced in accordance with the Safety Regulations of the State of California, Department of Industrial Relations, Division of Industrial Safety.

68-5 Boring And Jacking

Unless otherwise specified, the methods and equipment used in jacking operations shall be optional with the Contractor, provided that the proposed method is approved by the Engineer. Such approval, however, shall in no way relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth on the Plans or specified in the Contract Specifications, or these specifications. Only workers experienced in jacking operations shall be used in performing the work.

Excavation for the casing or concrete pipe not using a casing pipe shall be accomplished by boring or by hand digging. Sluicing or jetting with water will not be permitted. If the Contractor elects to utilize uninterrupted around-the-clock bore and jack operations to prevent "freezing" of the casing or carrier pipe, or to preclude instability at the heading of the bore and jack, or should the Contractor be required by the City or other permitting agencies to utilize such procedures upon encountering such conditions, the bore and jack operations, once commenced, shall be continued uninterrupted until casing or RC pipe installation is complete. Full compensation for additional costs incurred as a result of such continuous operations, including any overtime inspection involved, shall be considered as included in the Contract unit price paid per linear foot for the steel casing pipe item involved, and no additional compensation will be allowed therefor.

Steel casing pipe and carrier pipe shall be installed as shown on the Plans, in conformance with the Contract Specifications, these specifications, and as directed by the Engineer. Steel casing pipe shall be installed such that carrier pipe, when installed to the lines and grades shown on the Plans, will be approximately centered within its casing pipe.

Carrier pipe to be installed within steel casing shall be as indicated on the Plans and specified in the Contract Specifications. Casing spacers shall be installed within 2 feet of each end of the casing pipe, at each side of each carrier pipe joint, and at evenly spaced intermediate locations to provide a maximum distance between casing spacers of 5 feet on center. The carrier pipe shall be supported on skids during the installation of the pipe. The skids shall be installed in such a manner as to relieve the couplings from all load and bearing. Casing spacers shall be installed in conformance with the manufacturer's recommendations and as specified in these specifications.

At the successful completion of the installation, casing end seals shall be installed in accordance with Plans and Contract Specifications. Care shall be taken during the placement of these seals that the pipe is not damaged, deflected or displaced.

The Contractor shall diligently monitor soil and groundwater conditions encountered during casing and/or carrier pipe installation, and shall provide any and all necessary groundwater seepage control and dewatering.

The excavated hole, whether bored or hand dug, shall not be more than 1 inch in diameter greater than the outside limits of the casing (or reinforced concrete pipe jacked without casing pipe). If the nature of the material is such that caving will likely occur and which may result in a greater space than above specified, a metal shield or jacking head shall be installed which extends a minimum of 18 inches ahead of the jacked casing or pipe. The metal shield shall cover a minimum of the upper 1/2 of the periphery of the jacked casing or pipe. Excavation shall not proceed beyond the shield.

Where ground conditions at the face of the jacking pit are such that sloughing or caving of ground is likely to occur at the face of the excavation upon commencement thereof, the face of the pit shall be made stable so that an excessive void is not carried with the face of the excavation for the length of the casing or pipe. This may be accomplished by solid sheathing at the portal of the jack, or excavating and backfilling the face of the pit with cohesive material.

Cavities or voids outside the limits specified above, regardless of cause, shall be backfilled with sand, soil, cement, or cement mortar as provided herein or as directed by the Engineer. All casing pipe 24 inches in diameter or larger, and all reinforced concrete pipe 24 inches in diameter or larger, shall be furnished with preinstalled fittings suitable for attachment to grout pumping equipment. Such grout connections, unless otherwise indicated on the Plans, shall be placed at 30°, 120°, 240° and 330°, measured clockwise, from vertical, around the circumference of the casing or pipe, and at intervals in each row, along the pipe, of no greater than 10 feet. Alternate bottom holes shall be staggered, and alternate top holes shall be staggered, so that one hole will occur at the top every 5 feet and one hole will occur at the bottom every 5 feet.

Immediately after completion of the jacking or boring operation, if in the opinion of the Engineer, excessive voids have been created outside the jacked pipe, lean grout shall be injected through the grout connections in such a manner as to completely fill all voids outside the casing pipe or reinforced concrete pipe resulting from the jacking or boring operation. The lean grout shall consist of one part Portland cement to not more than 4 parts sand by volume, placed at low pressure. Grout pressure is to be controlled so as to avoid deformation of casing pipe and/or avoid movement of the surrounding soil. Sand for grout to be placed outside the casing shall be of such fineness that 100 percent will pass a No. 8 sieve and not less than 35 percent will pass a No. 50 sieve. After completion of grouting, the grout connections shall be closed with cast-iron threaded plugs.

For jacked reinforced concrete pipe, if the annular space in the joints on the inside of the pipe exceeds one inch, the space shall be filled with cement mortar for the full periphery of the joint and finished smooth and flush with the interior walls of the pipe. Filling and finishing annular spaces shall be accomplished after the entire installation is completed for larger pipe. The Contractor shall adhere to the safety requirements of Section 68-3, “Tunnel Safety Orders,” and Section 19-3.02, “Trench and Structure Excavation.”

In general, excavated material shall be removed from the casing or reinforced concrete pipe as jacking progresses and no accumulation of excavated material within the casing will be permitted. Should appreciable loss of ground occur in installations where the face of the excavation is accessible, the voids shall be backpacked promptly to the extent practicable with an approved soil cement.

68-6 Grade Tolerance

The Contractor's attention is called to the fact that extreme care will be required in placing the casing pipe so as to permit the construction of the carrier pipe to the lines and grades shown on the Plans. It shall be the Contractor's responsibility for selecting a size of casing, at or above the minimum specified, in order that the jacking may be done with a sufficient degree of accuracy to permit installation of the carrier pipe to the grade as shown on the Plans within the tolerances set forth in these Specifications for the particular carrier pipe installed. Any and all increased costs resulting from the Contractor's use of steel casing pipe with greater diameter or thickness than the minimum specified shall be borne solely by the Contractor. Variations from theoretical alignment and grade of the steel casing pipe at the time of completion of jacking shall not exceed one percent of the distance from the jacking point, except as follows.

Reinforced concrete pipe jacked into place without steel casing shall not vary from theoretical alignment and grade at the time of completion of jacking by more than 6 inches in 100 feet for storm drain, and 1 inch in 100 feet for sanitary sewer carrier pipe.

68-7 Frac-Out Contingency Plan

Unless otherwise specified in the Contract Specifications, a Frac-Out Contingency Plan will be required. Such Plan shall be prepared in accordance with the following provisions and submitted to the Engineer.

For jack-and-bore tunneling activities that use drilling lubricants, the Contractor shall prepare and implement a contingency plan that is intended to minimize the potential for a release of drilling lubricant (frac-out) associated with tunneling activities; provide for the timely detection of frac-outs; and ensure an organized, timely, and "minimum-impact" response in the event of a frac-out and release of drilling lubricant. The contingency plan shall include, at a minimum, the following measures:

1. A full-time monitor shall attend all drilling to look for observable frac-out conditions or lowered pressure readings on drilling equipment.
2. If a frac-out is identified, all work shall stop, including the recycling of drilling lubricant. In the event of a frac-out into water, the pressure of water above the tunnel may keep excess mud from escaping through the fracture. The location and extent of the frac-out shall be determined, and the frac-out shall be monitored for 4 hours to determine whether the drilling lubricant congeals (bentonite will usually harden, effectively sealing the frac-out location).
3. If the drilling lubricant congeals, no other actions shall be taken that would potentially suspend sediments in the water column.
4. Surface releases of bentonite shall be allowed to harden and then shall be removed.
5. The contingency plan shall identify additional measures to be taken to contain or remove the drilling lubricant if it does not congeal.

68-8 Backfill, Compaction, Restoration Of Surfaces

Jacking and receiving pits shall be backfilled and compacted, and the surface restored, in accordance with Section 19-3, “Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration.”

68-9 Measurement

Measurement for steel casing pipe jacked into place shall be by the lineal foot of casing pipe jacked into place as shown on the Plans or directed by the Engineer.

Measurement for reinforced concrete pipe with rubber gasket joints (without steel casing), jacked into place, shall be by the lineal foot of pipe jacked into place as shown on the Plans or directed by the Engineer.

Where carrier pipe is indicated on the Plans to be placed within a jacked casing pipe, carrier pipe will be measured by the lineal foot of pipe installed.

68-10 Payment

The unit price bid per lineal foot for steel casing pipe, jacked into place, shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as specified in the Specifications, and as directed by the Engineer. This shall include excavating, backfilling and compacting the jacking and receiving pits, boring and tunneling, furnishing and installing the casing complete with grout fittings, furnishing and installing metal shields, furnishing and installing skids and tie downs, spacers, bands, grouting and backfill of voids, sealing ends of casing, and all other incidental work over and above that associated with the normal work of furnishing and installing the carrier pipe in a trench situation.

The unit price bid per lineal foot for reinforced concrete pipe with rubber gasket joints, jacked into place, shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include, but not be limited to, excavating, backfilling and compacting the jacking and receiving pits, boring and tunneling, furnishing and installing the pipe complete with grout fittings, furnishing and installing metal shields, grouting and backfill of voids, and all incidentals.

Carrier pipe to be placed in casing pipe as shown on the Plans will be paid for on a lineal foot basis as normal in-trench pipe as set forth in these Specifications for the particular type of pipe to be installed.

SECTION 69 (BLANK)

SECTION 70 - MISCELLANEOUS STREET IMPROVEMENTS

70-1 General

This work shall consist of constructing or reconstruction of miscellaneous street improvements, including relocation of mail boxes, signs, fences or walls, witnessing and resetting survey monuments, lowering and adjusting existing facilities to finish grade, removal and replacement of connecting driveways, drive approaches, and other connecting facilities, all as shown on the Plans and applicable Standard Drawings, as specified in the Specifications, and as directed by the Engineer.

70-2 Survey Monuments

The Contractor shall comply with the provisions in Section 5-14, "Construction Surveying/Staking." Survey monument wells to replace known monuments to be damaged or destroyed by the work shall be furnished and installed at the locations shown on the Plans and as directed by the Engineer. The survey monument well shall be furnished and constructed in conformance with the applicable Standard Drawings. The Contractor shall retain a licensed land surveyor to survey and reset said monument and furnish and install the well and appurtenances.

All known monuments, corners, or other survey markers to be disturbed by the work shall be tied by temporary survey markers in conformance with professional standards prior to beginning construction. Temporary ties and resetting of monuments, corners, or other markers shall be performed by a licensed land surveyor obtained by the Contractor prior to beginning construction. Monuments, corners, or other markers shall be re-set to their original precise location and elevation, and marked as required. Known monuments, corners, or survey markers not to be disturbed by the work shall be protected from damage. Any known monuments, corners or markers damaged or destroyed due to the Contractor's failure to protect them shall be replaced in conformance with the applicable Standard Drawing and this Section 70-2 at the Contractor's expense.

70-3 Adjusting Existing Facilities To Finish Grade

Existing facilities shall include manhole frames and covers, water valve boxes and covers, water meter boxes and covers, and other similar existing facilities that must fit or match the final finished surface of the improvement in which they are located. The facilities shall be adjusted to grade within five (5) working days following the completion of the surfacing in which they are located.

Sewer, recycled water, and storm drain manhole frames and covers, and water or recycled water valve boxes and covers shall be temporarily lowered below the grading plane and triangulated or monumented to provide quick location throughout the construction process. The manhole frames and covers, and valve boxes and covers shall then be raised to finish grade, concrete collars poured and asphalt-concrete patch placed, in accordance with the Standard Drawings and as directed by the Engineer.

Other existing facilities shall be adjusted to finish grade in accordance with the applicable utility or facility authority involved, and as directed by the Engineer. Where the utility or facility authority involved desires to do the work with their own forces and/or materials, the Contractor shall pay all the costs associated therewith.

70-4 Measurement And Payment

Unless otherwise specified in the Contract Specifications, Miscellaneous Street Improvements shall be measured and paid for on a lump sum basis. Payment shall include full compensation for all labor, equipment and materials required to complete all the work described herein, as shown on the Plans and as specified in the Contract Specifications.

If the Contract does not include a pay item for Miscellaneous Street Improvements, the cost thereof shall be included in the prices bid for the other various items of work and no separate payment will be made therefor.

SECTION 71 (BLANK)

SECTION 72 (BLANK)

SECTION 73 - CONCRETE CURBS, SIDEWALKS, SURFACE IMPROVEMENTS

73-1 General

This work shall consist of constructing concrete curbs, gutters, curb and gutters, curb depressions, sidewalks, curb (wheelchair) ramps, driveway approaches, alley approaches, valley gutters, fence mowstrips and median caps of the form and dimensions shown on the Plans or Standard Drawings, as set forth in the Specifications, and as directed by the Engineer. Curb (wheelchair) ramps shall also comply with the most current Federal and State Accessibility Standards, whichever is more restrictive.

All concrete improvements as above defined shall be constructed by using fixed forms, except that curbs, curb and gutters, and alley gutters may be constructed by using an extrusion or slip-form machine.

73-2 Portland Cement Concrete

Concrete for curbs, sidewalks, and other surface improvements shall conform the requirements of Section 90, "Portland Cement Concrete," of the State Standard Specifications, and shall be Class 2 or Class 3, except valley gutters shall be Class 1 or 2.

For extruded or slip-formed concrete improvements, the maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 1 inch or smaller than 3/8 inch. For extruded or slip-formed concrete, the cement content shall be as specified for Class 2 concrete.

73-3 Reinforcement

Where the use of steel reinforcement is indicated on the Plans or Standard Drawings, it shall be furnished and installed in accordance with Section 52, "Reinforcement," of the State Standard Specifications, except that Sections 52-1.10, "Measurement," and 52-1.11, "Payment," of the State Standard Specifications are hereby deleted.

73-4 Subgrade Preparation

Subgrade Preparation shall conform to the requirements of Section 19-2.07, "Subgrade Preparation, Compaction," and shall be constructed true to grade and cross-section, as shown on the Plans or directed by the Engineer. It shall be thoroughly watered and rolled or hand tamped to obtain a relative compaction of no less than 95 percent under curbs, gutters, driveway approaches, valley gutters and handicap ramps, and a relative compaction of no less than 90 percent under sidewalks, mowstrips and concrete median caps prior to placing the concrete. All soft or spongy material shall be removed to a depth of not less than 18 inches or to stable soil below subgrade elevation for curbs, gutters, valley gutters and driveways and 3 inches below for caps, mowstrips, sidewalks and wheelchair ramps, and the resulting space filled with earth, sand or gravel of a quality that when moistened and compacted will form a stable foundation.

The subgrade and forms shall be wet immediately in advance of placing concrete.

73-5 Construction

Concrete shall not be placed on frozen or ice-coated ground or subgrade or on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints. Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage. All concrete that has been frozen, or damaged by other causes,

as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

Fixed form construction shall conform to Sections 73-1.04**, "**Fixed Forms,**"** 73-1.05A**, "**Fixed Form Curb Construction," and 73-1.06**, "**Sidewalk, Gutter Depression, Island Paving**,** Curb Ramp (Wheelchair Ramp), and Driveway Construction," of the State Standard Specifications, and as set forth in this Section 73-5. Extruded or slip-formed construction shall conform to Section 73-1.05B**, "**Extruded or Slip-Formed Curb Construction," of the State Standard Specifications, and as set forth in this Section 73-5. The extrusion machine shall go no faster than the curb and/or gutter or alley gutter can be finished using good workmanlike practices.

Construction Joints

Construction joints shall be as shown on the Standard Drawings, and as specified below for both fixed form and extruded or slip-formed construction, as follows:

(a) Where concrete improvements such curb and gutter, valley gutters, and sidewalk, are to be placed adjacent to existing pavement, the pavement shall be sawcut and removed 6 inches beyond the inside edge of the formwork. The edge of the existing pavement shall not be used as formwork.

(b) Expansion joints for curbs and gutters, sidewalks, mowstrips, valley or alley gutters, median island curbs and median caps shall be constructed at no greater than 45 foot intervals, and at the ends of curb returns. Expansion joints for curb, gutter and sidewalks and median curbs and caps shall be collinear. Expansion joints for curbs and gutters shall also be constructed on each side of curb depressions for driveway approaches. Expansion joints for sidewalks shall also be constructed on each side of driveway approaches. Expansion joints for fence mowstrips shall occur at post locations. All expansion joints shall be tooled with a 3/8 inch maximum radius edger, and filled with 3/8 inch thick premolded joint filler conforming to ASTM Specification Designation D1751.

(c) Weakened plane joints shall be placed at 15 foot intervals, except that for mowstrips they shall be placed at each post location not having an expansion joint. Weakened plane joints may be made by the use of plastic materials. Plastic weakened plane joint material shall be at least 1 inch deep, T-shaped 1/8 inch thick plastic strip, with a minimum ¾ inch wide pull-top stiffener. This plastic strip shall have a suitable anchor to prevent vertical movement. After preliminary troweling, the concrete shall be parted to a depth of approximately 2 inches with a joint knife or a thin metal straight edge. The plastic strip shall then be inserted in the impression so that the upper surface of the pull-top stiffener is flush with the concrete, and the pull-top stiffener shall be immediately peeled off. After the pull-top is removed, the concrete shall be floated to fill all voids adjacent to the strip. During final troweling, the edges at plastic control joints shall be finished to a radius not to exceed 1/8 inch using a slit jointer tool. The finished joint opening shall not be wider than 1/8 exclusive of radii.

(d) The above spacing for construction joints shall be required in lieu of the spacing indicated in Section 73**, "**Concrete Curbs and Sidewalks," of the State Standard Specifications.

(e) Mowstrips may not be poured monolithically with sidewalks or other concrete improvements.

The surface of sidewalks, wheelchair ramps and driveway approaches shall be scored, stamped, or otherwise marked as shown on the Plans, Standard Drawings, Contract Specifications, or as directed by the Engineer, utilizing a scoring tool, which will leave the edges rounded. The construction of wheelchair ramps shall include any special surfacing required to be affixed to the concrete surface.

Where steel dowels are set forth on the Plans to anchor proposed concrete curbs to existing pavement, adhesives may not be substituted therefor.

73-6 Finish

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

Finish of concrete surface improvements shall be free from blemishes and shall be as follows:

(a) Curbs - Trowel smooth and finish with a light brush.

(b) Sidewalks and mowstrips – Broom Finish or Medium sweat finish.

(c) Gutters, valley gutters and median caps -Finish with medium broom.

(d) Driveway approaches - Finish with a medium broom, except wings shall be finished with a light broom and sidewalk area to receive a broom finish or a medium sweat finish.

(e) Wheelchair ramps - Finish as indicated on the Standard Drawings.

(f) Stamped Concrete – Shall be colored, sealed and constructed per the project specifications and construction plans and as directed by the Engineer.

Broomed surfaces to be used by pedestrian traffic shall be broomed transverse to the line of traffic.

73-7 Tolerances

The top and face of finished curbs shall be true and straight and the top surface of curbs shall be of uniform width, free from humps, sags, or other irregularities. When a straightedge 10 feet long is laid on the top or face of the curb or on the surface of gutters, or valley gutters, the surface shall not vary more than 1/8 inch from the edge of the straightedge, except at designed grade changes or curves.

The surface of sidewalks, wheelchair ramps, driveway and alley approaches, mowstrips and median caps shall not vary more than 3/16 inch along a 10 foot straightedge, except at grade changes.

73-8 Curing

All surface concrete improvements shall be cured by application of an approved curing compound in conformance with the requirements of Subsection 90-7.01B**, "**Curing Compound Method," of the State Standard Specifications.

73-9 Backfilling

After removal of forms, the area adjacent to the newly constructed concrete improvement shall be cleaned of all surplus concrete and other debris and the area filled with clean earth suitable for planting (except in front of the gutter). Backfill shall be placed behind the curb prior to any excavation in the street area below the plane of the bottom of curb and gutter.

Where there is a planter strip between the curb and the sidewalk, the planter strip shall be filled to within 1 inch of the top of curb and sidewalk with clean earth suitable for planting. The area of traffic divider (median) islands not to be capped with concrete shall be backfilled with clean earth suitable for planting to within 2 inches of a line extending between adjacent tops of curb.

73-10 Measurement

Unless otherwise specified in the Contract Specifications, concrete curb, concrete gutter, alley gutter, concrete curb and gutter, and concrete mowstrip shall be measured by the lineal foot. Curb depressions will be included in the measurement of length of concrete curb, or concrete curb and gutter, as the case may be.

Unless otherwise specified in the Contract Specifications, concrete sidewalks and wheelchair ramps, concrete driveway approaches, concrete alley approaches, concrete valley gutters and concrete median caps shall be measured by the square foot. Measurement of concrete driveway approaches and concrete alley approaches shall be made from the back of the curb to the back of the approach.

73-11 Payment

Payment for concrete curb, concrete gutter, concrete curb and gutter, and concrete mowstrip shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer, including subgrade preparation.

Payment for concrete sidewalks and wheelchair ramps, concrete driveway approaches, concrete alley approaches, concrete valley gutters and concrete median caps shall include full compensation for furnishing all labor, materials, tools, equipment, special surfacing materials, and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer, including subgrade preparation. Compensation for steel reinforcement required for concrete valley gutters or any other facilities requiring steel reinforcement shall be included in the cost for concrete valley gutters or other facilities requiring steel reinforcement.

SECTION 74 THROUGH 79 (BLANK)

RIGHT OF WAY AND TRAFFIC CONTROL FACILITIES

SECTION 80 - CHAIN LINK FENCE, GATES; TIMBER BARRICADES

80-1 General

This work shall consist of constructing chain link fence and gates at locations and in accordance with the details shown on the Plans and Standard Drawings, as specified in the Specifications, and as directed by the Engineer. Concrete mowstrips for fences shall conform to Section 73, "Concrete Curbs, Sidewalks, Surface Improvements." The work shall also consist of constructing timber barricades at the locations shown on the Plans, and in accordance with the applicable Standard Drawing and the Specifications.

80-2 Materials

All fence and gate materials shall be new, galvanized ferrous materials. Imperfectly galvanized material or material upon which serious abrasions of the galvanizing occur shall not be used in the work. A certificate of compliance may be required from the manufacturer of all products used in constructing chain link fence and gates, including posts, and shall be submitted to the Engineer in conformance with Section 6-5, "Certificates of Compliance."

All timber shall be new and first quality.

80-2.1 Fence, Gate, Posts

Fence, gate, and post materials shall comply with the following:

1. Height: The fence shall stand at a height of 6 feet above the grade indicated on the Plans when erected.

2. Fabric: Chain link fence and gate fabric shall conform to the specifications of ASTM Designation A392, Class 1 zinc coating. The wire used in the manufacture of the fabric shall be 9 gauge, and woven into approximately 2 inch mesh. The upper edges of the fabric shall have the wire ends bent back to form a closed loop (knuckled).

3. Posts and Braces: The base material for the manufacture of steel pipe used for posts and braces shall conform to the specifications of ASTM Designation A120, standard weight, and the base material for the manufacture of other steel sections used for posts and braces shall be good commercial quality weldable steel. Posts and braces shall be galvanized in accordance with ASTM Specification Designation A123.

Posts and braces shall conform to the following requirements:

<u>Corner and End Posts</u> (round pipe only):

Pipe: 2-7/8 in. outside diameter (O.D.); 5.79 lb./ft. weight

<u>Line Posts:</u>

Pipe: 2-3/8 in. O.D.; 3.65 lb./ft. weight

H Section: 2 x 2-1/4 in.; 4.1 lb./ft. weight

Gate Posts (round pipe only):

Individual Gate Width	O.D.	Weight
Up thru 6 ft.	2-7/8 in.	5.79 lb./ft.
7 ft. thru 13 ft.	4 in.	9.11 lb./ft.
14 ft. thru 18 ft.	6-5/8 in.	18.97 lb./ft.
Over 18 ft.	8-5/8 in.	24.70 lb./ft.

Braces:

Pipe:	1-5/8 in. O.D.;	2.27 lb./ft. weight
H Section:	1-1/2 in. x 1-5/16 in.	

All posts shall be fitted with rainproof caps designed so as to fit securely over the top of the posts, and carry the top tension wire, except that the top of H Section posts may be open-slotted in such a manner as to securely hold the top tension wire in position without vertical movement. Such slotting shall allow removal and replacement of a post without disturbing the top tension wire.

All posts shall be of a total length of not less than 9 feet as shown in the Standard Drawings, except that where post caps are used which hold tension wires, the post may be shortened a sufficient amount so that the top of the cap is at the approximate level of the fence fabric, but no lower. In no case, however, shall the post be shorter than 8' 8" where post caps are used, nor shall the length embedded in the concrete footing, including any mowstrip, be less than 3 feet.

Reference is made to Section 6-8, "Samples and Tests," which is modified in this Section 80-2.1. In addition to any of the requirements of said Section 6-8, one post from each lot of posts, and one brace from each lot of braces, to be used in the work shall, at the direction of the Engineer, be tested in accordance with the requirements of ASTM Designation A120. If that post or brace fails, 2 additional posts or braces from the same lots will be tested. If either of the 2 additional sampled posts or braces fails, the entire lot of posts will be rejected.

80-2.2 Extension Arms, Tension Wire, Wire Strands

1. Extension arms, stretcher bars and other required fittings and hardware: Extension arms, stretcher bars and other required fittings and hardware shall be steel or malleable iron or wrought iron and shall be galvanized in accordance with ASTM Specification Designation A153.

2. Tension wires: Tension wires shall be a minimum of 7 gauge coil spring steel of good commercial quality. Tie wires and hog rings shall be at least 9 gauge steel. Post clips shall be at least 6 gauge steel. Tension wires, tie wires, post clips, and hog rings shall be galvanized in accordance with the provisions of ASTM Specification Designation A116, Coating Class 3.

3. Wire Strands for Extensions: Wire strands for extensions shall be 9 gauge (3.8 mm) diameter galvanized steel of a good commercial quality. Three strands shall be installed where extensions are called for on the Plans.

80-2.3 Gates

Drive gates may be single or double, and shall be of the widths designated on the Plans and in the Contract Pay Item. Walk gates shall be 4 feet wide. Gates shall be constructed in accordance with the Standard Drawings.

Gate frames shall be constructed of not less than 1-1/2 inch inside diameter galvanized standard weight pipe conforming to ASTM Specification Designation A120. Gate frames shall be cross trussed with 3/8 inch diameter adjustable truss rods. The adjuster shall be provided with flat and lock washers and shall be "double-nutted" to lock the adjuster. The corners of gate frames shall be fastened together and reinforced with a malleable iron fitting designed for the purpose, or they may be welded and regalvanized as provided herein.

All abraded and damaged galvanized surfaces or welded areas shall be regalvanized or may be cleaned and painted with two coats of zinc oxide, zinc dust paint conforming to the requirements of Federal Specification MIL-P-15145, the paint to be properly compounded in a suitable vehicle in the ratio of one part zinc oxide to 4 parts zinc dust, by weight.

Chain link fence fabric specified for the fence shall be attached to the gate frame by the use of stretcher bars and the tie wires as specified for fence construction, and suitable tension connectors spaced at approximately one foot intervals.

The gates shall be hung by at least two steel or malleable iron hinges not less than 3 inches in width, so designed as to securely clamp to the gate posts and permit the gate to be swung back against the fence.

Gates shall be provided with a combination steel or malleable iron catch and locking attachment of approved design. Stops to hold gates open and a center rest with catch shall be provided for all double gates. Walk gates shall be provided with stops only.

80-2.4 Concrete

Concrete for post footings shall be Class 3 conforming to the requirements of Section 90, “Portland Cement Concrete,” of the State Standard Specifications.

80-2.5 Timber

Timber for Timber Barricades shall conform to the requirements shown on the Standard Drawing for Temporary Timber Barricade.

80-3 Clearing And Grubbing

Clearing and Grubbing shall conform to the requirements of Section 16, “Clearing and Grubbing.”

80-4 Excavation And Preparation Of Subgrade

Any required excavation or embankment construction shall be to the lines and grades shown on the Plans or established by the Engineer. Excavation, embankment construction and preparation of subgrade shall conform to the requirements of Section 19**, “**Earthwork.” Unless otherwise indicated, minimum relative compaction of finished fence pad shall be 90 percent.

The area around each gate shall be graded to allow all gates to be swung back against the fence without dragging on the ground surface.

80-5 Construction

1. Chain Link Fence, Gates.
   Line posts shall be spaced not farther apart than 10 feet from center to center, and unless otherwise specified, shall be set vertically. All posts shall be set in concrete footings conforming to details show on the Standard Drawings. Unless otherwise directed by the Engineer, footings shall be crowned at the top to permit water to flow away from the posts.

   End, corner and gate posts shall be braced to the nearest line post as shown on the Standard Drawings, with horizontal braces used as compression members and galvanized 3/8 inch diameter steel adjustable truss rods used as tension members. The adjuster shall be provided with flat and lock washers, and shall be "double-nutted", as directed by the Engineer, to lock the adjuster. Where the distance between corner and/or gate posts is 1,000 feet or greater, line posts shall be braced horizontally and trussed in both directions at intervals not to exceed 1,000 feet, as shown on the Standard Drawings. The tension wires shall be interrupted at this location by cutting and attaching them to one of the braced line posts. Tension wires shall then be continued from this same line post to the next corner or gate post.

   Changes in line where the deflection angle is 10 degrees or more shall be considered as corners, and corner posts with bracing specified for corners shall be installed.

   Chain link fabric shall be fastened on the outside of the posts surrounding the area being fenced, unless otherwise directed by the Engineer.

   The fabric shall be stretched and securely fastened to the posts, and between posts the top and bottom edges of the fabric shall be fastened to the tension wires. Tension wires shall be stretched tight and attached to corner or gate posts in a manner approved by the Engineer.

   The fabric shall be fastened to end, corner and gate posts with ¼ inch wide by ¾ inch thick stretcher bars and not less than 1/8 inch wide by ¾ inch thick stretcher bar bands spaced at 1 foot intervals. The fabric shall be fastened to line posts with tie wires or post clips and to tension wires with tie wires or hog rings. The wire or clip fasteners shall be spaced 14 inches apart on line posts, with a minimum of 6 per post, and 18 inches apart on tension wires.

   All bolted fixtures, including gate hinge attachments, turnbuckles, or other adjusters, clamps, or any device which is bolted, shall be provided with flat washers behind bolt heads, except where stove bolts are used, and flat and lock washers behind nuts. All turnbuckles or other adjusters shall be "double-nutted" to lock the adjuster.

   Where post extensions and strands of wire are specified, the wire shall be stretched tight and fastened to extension arms with tie wires or hog rings. Where the wire terminates, it shall be securely tied to the extension arm.

2. Timber Barricades.
   Timber Barricades shall be constructed at the locations shown on the Plans and conforming to the details shown on the Standard Drawing for Temporary Timber Barricade. Use of the word “Temporary” shall not be confused with smaller barricades used for traffic delineation.

Clearing and grubbing for Timber Barricades shall conform to Section 16, "Clearing and Grubbing." Excavation and preparation of subgrade shall comply with Section 80-4, "Excavation and Preparation of Subgrade." Excavations for posts shall be backfilled and thoroughly compacted to the satisfaction of the Engineer.

80-6 Measurement

Measurement for 6-foot chain link fence will be by the lineal foot of chain link fence installed as shown on the Plans, to be determined by the Engineer from actual measurements, the width of gate openings being deducted.

Measurement of gates will be per each for each type of gate installed as shown on the Plans. A gate unit complete in place shall include one gate, or in the case of double gates, one double unit, with all necessary fittings, hardware, and gate posts with braces, latches, stops, and other devices required by the Standard Drawings, Plans or Specifications.

Measurement for Timber Barricades shall be on an each basis.

80-7 Payment

When the Contract does not include a pay item for clearing and grubbing, or for excavation and preparation of subgrade as above specified, and unless otherwise provided in the Contract Specifications, full compensation for any necessary clearing and grubbing, and any excavation and preparation of subgrade required to prepare the fence pad to the grades shown on the Plans or directed by the Engineer shall be included in the costs for the various fence construction items of work and no separate payment will be made therefor.

Payment for 6 foot chain link fence shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans and Standard Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include clearing and preparing the fence pad (where no separate item is provided therefor), furnishing and installing the fence and posts, providing samples and tests, furnishing and installing post extension arms and strands of wire where indicated, and all incidentals required to provide a complete fence installation as specified.

Payment for each type of gate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans and Standard Drawings, as set forth in the Specifications, and as directed by the Engineer. This shall include clearing and preparing the gate opening area (where no separate item is provided therefor), furnishing and installing gates, providing samples and tests, furnishing and installing post extension arms and strands of wire where indicated, and all incidentals.

Payment for Timber Barricades shall include full compensation for all labor, tools, materials, and incidentals required for the complete installation as shown on the Plans and applicable Standard Drawings, and as specified in the Specifications, including paint and reflectors.

SECTION 81 - CONCRETE MASONRY WALL (FENCE)

81-1 General

This work shall consist of furnishing all materials and constructing a concrete masonry wall at the locations, lines and grades as shown on the Plans, in conformance with Standard Drawings, as specified in the Specifications, and as directed by the Engineer. Included is the footing and pilaster construction, reinforcing steel, concrete masonry units and other facilities to complete the wall.

For purposes of consistency, the term "wall" as used in this Section 81 shall also mean "Fence" as said term is used in the Uniform Building Code for this type of construction.

81-2 Materials

Materials for concrete masonry wall and pilaster construction shall be as follows:

1. Concrete Masonry Units: Hollow load bearing masonry units shall be Grade A units conforming to the ASTM Specification Designation C90 and in addition the requirements of the Quality Control Standards of the Concrete Masonry Association. All masonry units shall be sound and free of cracks and other defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction. Minor cracks incidental to the usual method of manufacture, or minor chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection.

2. Cement: Cement shall be Type I or Type II Portland cement conforming to ASTM Specification Designation C150.

3. Mortar: Mortar shall be freshly prepared and uniformly mixed in the ratio of one part Portland cement, 1/4 part minimum to 1/2 part maximum lime putty or hydrated lime, damp loose sand not less than 2½ and not more than 3 times the sum of the volumes of the cement and lime used (4½ parts maximum), and shall conform to ASTM Specification Designation C270. If plastic type cement is used, lime putty shall be omitted.

4. Grout: Grout for pouring or pumping shall be as follows:

   (a) Grout for pouring shall be of "fluid consistency" and shall conform to ASTM Specification Designation C476. "Fluid consistency" shall mean as fluid as possible for pouring without segregation of the constituent parts. It shall be freshly prepared and uniformly mixed in the ratio of volumes as follows:

Type	Grout Space in its Least Dimension	Portland Cement (parts)	Damp Loose Sand (parts)	Damp Loose Aggregate (parts)
Fine	Less than 3 in.	1	2¼ min - 3 max	
Coarse	3 in. or more	1	2 min - 3 max	1 to 2

   (b) Grout for pumping shall be of "fluid consistency" as defined above and shall have not less than seven sacks of cement in each cubic yard of grout.

5. Lime: Hydrated lime shall conform to ASTM Specification Designation C207.

6. Aggregate: Aggregate for mortar shall conform to ASTM Specification Designation C144. Aggregate for grout shall conform to ASTM Specification Designation C404.

7. Concrete: Portland cement concrete for footing shall be Class 2 conforming to the requirements of Section 90, "Portland Cement Concrete," of the State Standard Specifications, or as indicated in the applicable Standard Drawings.

8. Reinforcing steel: Reinforcing steel shall be deformed bars conforming to ASTM Designation A15 and A305, except that ¼" ties may be plain bars. Wire reinforcement shall conform to ASTM Specification Designation A82.

81-3 Clearing And Grubbing
Clearing and Grubbing shall conform to the requirements of Section 16, "Clearing and Grubbing."

81-4 Excavation and Subgrade Preparation
Any required excavation or embankment construction for the wall footing shall be to the lines and grades shown on the Plans or established by the Engineer. Excavation, embankment construction and preparation of subgrade shall conform to the requirements of Section 19, **"**Earthwork." Unless otherwise indicated in the Plans or Contract Specifications, minimum relative compaction of finished subgrade for wall footing shall be 90 percent.

81-5 Wall Construction
The wall construction, including pilasters and footings, shall be of the highest quality workmanship and all walls shall be laid true, level, plumb and neat and in accordance with the Plans and the Standard Drawing pertaining thereto.

Forms for footing construction shall be straight and true. The exposed (after wall construction) finish top surface of the footing shall be a medium sweat finish.

Mortar and grout shall be mixed by placing half of the water and sand in the operating mixer. Then the cement, lime and remainder of the sand and water shall be added. After all ingredients are in the batch mixer, they shall be mechanically mixed for not less than 5 minutes. Hand mixing shall not be employed unless specifically approved. The mortar should be retempered with water as required to maintain high plasticity. Retempering on mortar boards shall be done only by adding water within a basin formed with the mortar and the mortar reworked into the water. Retempering may only be done prior to hardening of the mortar. Any mortar and grout which is unused after 1½ hours from initial mixing time shall be discarded.

For bonding the masonry to the foundation, the top surface of the concrete foundation shall be clean and with laitance removed and aggregate exposed before starting the masonry construction. The starting joint on foundations shall be laid with full mortar coverage on the bed joint, except the area where grout is to contact the foundation.

Mortar joints shall be straight, clean, and uniform in thickness and shall be tooled. Tooling shall be done when the mortar is partially set but still sufficiently plastic to bond. All tooling shall be done with a tool that compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out. Joints that are not tight at the time of tooling shall be raked out, pointed, and then tooled. If it is necessary to move a masonry unit after it has been once set in place, the unit shall be removed from

the wall, cleaned and set in fresh mortar. Lintels, capping units and all bearing plates set by the mason shall be set in a full bed of mortar.

All cells, whether containing reinforcement or not, are to be filled with grout. All grout shall be puddled or vibrated in place to consolidate without separation. Mortar droppings should be kept out of the grout space. Mortar that projects into the grout space shall be removed so that protrusions will not restrict the flow of grout (grout will tend to bridge at these locations and require too much puddling or vibration to assure complete filling of grout space). Vertical cells to be filled shall have a vertical alignment to maintain a continuous unobstructed cell area not less than 2 x 3 inches. Grout for cells containing reinforcement shall be stopped 1½" below the top of a course to form a key at pour joints.

Reinforcing bars shall be straight except for bends or hooks as detailed on the Standard Drawings. Horizontal reinforcing bars shall be laid on the webs of the masonry units in continuous masonry courses, consisting of bond-beam or channel units, and shall be solidly grouted in place. Vertical reinforcing steel shall have a minimum clearance of ¼ inch from the masonry, and not less than one bar diameter between bars. Wire reinforcement shall be completely embedded in mortar or grout. Joints with wire reinforcement shall be at least twice the thickness of the wire.

Concrete scum, and grout stains on the wall shall be removed immediately. After the wall is constructed, it should not be saturated with water for curing or any other purpose. At the conclusion of the masonry work, the Contractor shall clean all the masonry, remove equipment used in the work, and remove all debris, refuse, and surplus masonry material, and dispose of them away from the premises.

81-6 Measurement

Measurement for concrete masonry wall will be by the lineal foot of concrete masonry wall installed as shown on the Plans, to be determined by the Engineer from actual measurement.

81-7 Payment

When the Contract does not include a pay item for clearing and grubbing or excavation and preparation of subgrade as specified in this Section 81, and unless otherwise provided in the Contract Specifications, full compensation for any necessary clearing and grubbing, and any excavation and preparation of subgrade required to prepare the subgrade and pad for the wall foundation, as shown on the Plans or directed by the Engineer, shall be considered as included in the price bid for concrete masonry wall and no separate payment will be made therefor.

Payment for Concrete Masonry Wall shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as set forth in the Specifications, and as directed by the Engineer. This shall include clearing and preparing the wall pad and subgrade (where no separate item is provided therefor), constructing pilasters and concrete footings, furnishing and placing reinforcing steel, concrete block, mortar and grout, and all incidentals.

SECTION 82 - FIBER OPTIC FACILITIES

82-1 General

This work shall consist of furnishing and installing fiber optic facilities including conduit, fiber optic cable, warning tape, pull tape, wire, conductors, tracer wire, pull boxes, cabinets and foundations, and all incidentals thereto for a complete and functional fiber optic system, all in accordance with the Plans, the applicable Standard Drawings, and Specifications, and as directed by the Engineer.

82-2 Equipment List And Drawings

Where required to be submitted to the Engineer by the Plans or the Contract Specifications, equipment lists and drawings of equipment and material to be furnished shall conform to the applicable provisions in Section 86-1.04, "Equipment List and Drawings," of the State Standard Specifications and these Standard Specifications. The equipment list shall give firm delivery dates for materials. In the event these dates cannot be met, the equipment supplier and Contractor shall provide documentary proof of search for alternate sources of supply at least thirty (30) calendar days prior to the stated delivery dates. Such action shall not be justification for granting additional working days but shall be evidence of proceeding to completion in good faith.

82-3 Regulations And Codes

Any electrical equipment and material required to be furnished shall conform to the provisions of Section 86-1.02, "Regulations and Codes," of the State Standard Specifications, to the California Electrical Code, and to modifications as specified in these Standard Specifications. The Contractor shall notify the Engineer at least two (2) working days in advance of any electrical work and also at least two (2) working days in advance of any work done intermittently in order that inspection required by the Electrical Code can be coordinated.

82-4 Fiber Optic Conduit

Unless otherwise shown on the Plans or specified in the Contract Specifications, fiber optic conduit shall be 3 inch diameter HDPE or PVC Schedule 40 or 80, furnished and installed as shown on the Plans, in conformance with the Specifications, and as directed by the Engineer.

82-5 Pull Tape

Pull-tape shall be installed in each fiber optic conduit. Each end of each fiber optic conduit shall be fitted with an approved, watertight expansion plug with integral provisions for secure attachment of the pull tape. The ends of the tape shall be secured to the expansion plug to ensure that the tape does not draw back into the conduit. Pull tape shall be flat, woven, polyester, have a minimum pull (tensile) strength of not less than 2,500 lbs., and shall be printed with sequential measurement markings for its full length. The length of pull tape provided in each conduit shall include a minimum of 72 inches of excess tape in each pullbox or other terminating enclosure.

82-6 Couplings And Bells

All couplings shall be a compression type fitting. Communication bells installed on the ends of conduits shall be glued. Bells shall be installed on each conduit that enters or exits any type of pull box or vault. Sweep and entrance construction for vaults and pull boxes shall conform to the details shown on the Plans.

82-7 Excavation And Backfill And Compaction

Unless otherwise shown on the Plans or specified in the Contract Specifications, the excavation, backfill, and compaction for fiber optic conduit, pull boxes, cabinets, including potholes, boring and receiving pits, or any disturbances of existing surfaces caused by operations related to fiber optic

facilities installation, shall comply with Section 8-15, "Utility and Non-Street Facilities; Potholing," and Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration."

82-8 Fiber Optic Conduit Installation

Fiber optic conduit installation shall conform to the details shown on the Plans and as specified in the Specifications. Unless otherwise specified, the Contractor may install fiber optic conduit by open trench methods, or by direct horizontal boring methods, except that the Engineer may prohibit the use of direct horizontal boring methods where such methods are determined to be inadvisable, in the opinion of the Engineer. In either case, the Contractor shall comply with the requirements of Section 8-15, "Utility and Non-Street Facilities; Potholing." Where direct horizontal boring methods are used, the Contractor shall expose and determine the locations of all crossing and adjacent utility facilities in advance by pothole excavation. A minimum separation of 12 inches shall be maintained between fiber optic conduit and other facilities. Fiber optic conduit shall be pitched to drain toward access boxes or vaults. No change in horizontal or vertical alignment from that shown on the Plans will be permitted without the express approval of the Engineer. The ends of each conduit shall be sealed with "Ductseal" or other electrical sealing compound approved by the Engineer.

82-8(A) Direct Horizontal Boring

Where direct horizontal boring is permitted by the Plans, Contract Specifications, or authorized by the Engineer, the process shall generally consist of the use of the technique of creating and directing a bore hole along a predetermined path to a specified target location where indicated on the plans to install conduits. This technique shall involve the use of mechanical and hydraulic equipment to change the boring course and shall use instrumentation to monitor the location and orientation of the boring head assembly along the predetermined course. The Contractor shall comply with Section 8-15, "Utility and Non-Street Facilities; Potholing," and Section 82-10, "Tracer Wire," prior to commencing with boring operations.

Drilling shall be accomplished with fluid-assisted mechanical cutting. Unless otherwise approved, boring fluids shall be a mixture of bentonite and water or polymers and additives. Bentonite sealants and water will be used to lubricate the drilling head. It is mandatory that minimum pressures and flow rates be used during drilling operation so as not to fracture the subgrade material around/or above the bore. Uncontrolled jetting (where the primary purpose is to use fluid force to erode soil for creation of the final bore hold diameter) is prohibited. The drilling system shall utilize small-diameter fluid jets to fracture, and mechanical cutters to cut and excavate the soil as the head advances forward. After installation of conduit in the bored hole, the hole shall be sealed with bentonite slurry.

Where it is necessary for the Contractor to install conduits by open trenching, they must be in accordance with the project details and all applicable specifications. Other installation methods such as the Flow Mole method may be approved by the Engineer, upon receipt and approval of a written proposal from the Contractor.

No change in horizontal or vertical alignment from that shown on the Plans will be permitted without the express approval of the Engineer.

82-9 Conduit Deflection (Deformation) Test

Unless otherwise noted on the Plans or specified in the Contract Specifications, all fiber optic conduit shall be tested for excessive deflection. This test shall be performed after backfilling and compaction but prior to the placement of aggregate base or asphalt-concrete surfacing, and prior to installing fiber optic cable where specified.

The Contractor shall demonstrate that the maximum pipe deflection (deformation) does not exceed 5 percent of the nominal pipe interior diameter by pulling a properly sized rigid ball or a mandrel through the conduit. A "rubber flush ball" does not meet the requirement for deflection testing.

Failure of the deflection test shall be grounds for rejection of the section tested. The Contractor shall undertake measures necessary to correct the deflection. Retesting of the failed section will be conducted to affirm correction.

82-10 Tracer Wire

A tracer wire shall be installed on the outside of the conduits including all sweeps, whether the conduit is installed by open trench or direct horizontal boring, methods, with each fiber optic conduit run. Only one wire is required for multiple conduit installations. Tracer wire shall be stranded 10 gauge copper wire with white insulation. The wire shall be firmly secured in an approved manner to the top center of single conduit installations or at the location shown on the Plans or designated by the Engineer for multiple conduit runs to limit disturbance during backfill operations. The tracer wire shall extend along all sweeps, and from pullbox to pullbox or to cabinets, with at least 10 feet of wire extending into each pullbox or cabinet. Tracer wire ends shall not be connected or grounded. Tracer wire may shall not be placed on the inside of conduit installed by direct horizontal boring methods, but shall be affixed to the outside of the conduit in a manner approved by the Engineer.

82-11 Damaged Conduit

Damaged conduit shall not be installed and removed from the jobsite. If the conduit is damaged during or after installation, the conduit shall be replaced or repaired to the satisfaction of the engineer. Any fiber optic conduit whose inner surface is damaged or not smooth, or is clogged or crushed shall be replaced.

82-12 Restoration Of Surfaces

Restoration of Surfaces shall be performed in accordance with the details shown on the Plans, as specified in the Contract Specifications, and with Section 19-3, “Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration.”

82-13 Adjusting And Cleaning

Upon completion of installation of fiber optic conduits and boxes, inspect interiors of fiber optic conduits and boxes and clear all blockages, remove burrs, dirt, and construction debris. Reference is made to Section 82-9, “Conduit Deflection (Deformation) Test.”

82-14 Fiber Optic Pullboxes

Pullboxes shall be furnished and installed in conformance with Section 86-16, “Pullboxes” and the applicable Standard Drawings except as modified in this Section 82-14. Unless otherwise shown on the Plans or specified in the Contract Specifications, Pullboxes shall be Christy Model N48T, with two extensions and a two-piece bolt-down lid. The lid shall be inscribed “Communications.” Fiber Optic Pullboxes shall be installed at the locations and in conformance with the details shown on the Plans. Where shown on the Plans or specified in the Contract specifications, bonding and grounding shall be provided conforming to the provisions of Section 86-19, “Bonding and Grounding.” Fiber optic conduit tracer wire ends shall not be connected nor grounded in pullboxes.

Installation of pullboxes shall comply with the following special requirements:

1. The joints between the pulbox and extensions, and between the extensions, shall be grouted. A layer of roofing paper shall be wrapped around the outside of the pullbox and extensions before backfilling.

2. The Contractor's attention is directed to Section 86-2.06C, "Installation and Use," of the State Standard Specifications. Conductors and Fiber Optic Cables shall not be installed in the pullbox prior to grouting the pullbox.

3. A sump consisting of clean ¾-inch crushed gravel shall be installed beneath the pullbox. The sump and gravel shall be 12 inches deep and extend 6 inches beyond the outside edges of the pullbox.

4. The bottom of the pullbox shall consist of a 1 inch minimum thickness non-shrink grout placed over a layer of roofing paper installed between the grout and the gravel sump. The grout shall be sloped to drain to the center of the bottom where a 2 inch diameter drain hole shall be installed through the grout and roofing paper.

5. Conduits shall enter the pullbox at the top of the bottommost extension. Conduits shall extend into the pullbox a maximum of 3 inches and a minimum of 2 inches. Conduits shall not enter the pullbox from the bottom without the express approval of the Engineer.

Connection of existing or new conduits to pullboxes shall be included as part of pullbox installation. The distance between conduits entering pull boxes shall be a minimum of 2 inches. After conductors have been installed in the conduit runs, the ends of conduits terminating in pull boxes shall be sealed with an approved type of sealing compound.

Pull boxes shall be placed at the same elevation as adjacent existing or future sidewalk area where finish elevations are not shown on the plans. The top elevation for pull boxes installed in median areas shall match the slope of the two adjacent curbs. The pull box elevation for pull boxes installed in planting areas adjacent to sidewalk or sidewalk area shall be at sidewalk grade. Pull boxes shall not be located within the limits of handicap ramps. When pull boxes are to be placed in dirt and planting areas adjacent to curbs, a concrete collar shall be constructed around the pull box and abut the curb. The top of the pull box shall match slope of the adjacent top of the curb. The surface elevation of the collar shall match the surface elevation of the pull box and slope away from the pull box at the rate of 1:50 (2% slope). The width of the collar shall be 12 inches wide and 6 inches in depth.

The Contractor shall clean all pull boxes entered for installation of conduit or wire of all dirt and debris. All pull box lids damaged by Contractor operations shall be replaced at his expense. The wiring in pull boxes shall be neatly bundled, coiled and reinstalled in the box.

Where existing pull boxes are removed and replaced with new larger boxes, the existing conduits within which the fiber cable is installed shall be cut back to within 2.5 inches of the edge of the new box. When the conduits are cut, the existing conductors must be either be removed or well protected. The ends of the cut conduits must have bushings placed on them. The bushings can be threadless.

At completion of all work in pull boxes, an approved ant repellent (Rainbow Insect Control Distributed by Southwest Power, (800) 670-7746, or an approved equal) shall be supplied by the Contractor in quantity specified by the Contract Specifications.

82-15 Fiber Optic Cabinets
Fiber optic cabinets shall be furnished conforming to the type and model shown on the Plans or specified by the Contract Specifications, and to Section 86-3.04,"Controller Cabinets," of the State Standard Specifications. The cabinets shall be installed at the locations and in conformance with the details shown on the Plans. Fiber optic cabinets shall be Anodized Aluminum, McCain Model 336A, equipped with Corbin Locks, Lamp Assembly, Service Panel, 19 inch Cage Assembly, Fan/Thermostat Assembly, and Anchor Bolts. Cabinets are to be mounted on a concrete pedestal as specified in the Caltrans Standard Plans for this model,, and shall be anchored to the pedestal in conformance with the manufacturer's recommendations or details shown on the Plans or any referenced Standard Drawings. Concrete for fiber optic cabinet pedestals shall be Class 2 concrete conforming to the provisions in Section 90, "Portland Cement Concrete," of the State Standard Specifications. Tracer wire shall be installed to and inside cabinets consistent with Section 82-10, "Tracer Wire." After conductors have been installed in the conduit runs, the ends of conduits terminating in cabinets shall be sealed with an approved type of sealing compound.

82-16 Fiber Optic Markers
Where required, fiber optic markers shall be furnished and installed at the locations and in conformance with the details shown on the Plans, as specified in the Contract Specifications, and as directed by the Engineer in accordance with the manufacturer's recommendations.

82-17 Fiber Optic Cable
All fiber optic cable for each project shall be single mode type from the same manufacturer, who is regularly engaged in the production of this material. The glass used shall be manufactured by Corning. The Contractor shall submit to the Engineer for approval a certification that the Manufacturer has been engaged in the production of this material for a minimum of three (3) years. The optic fibers shall be contained with loose buffer tubes. The loose buffer tubes shall be stranded around an all-dielectric central member in a Reverse Oscillation Lay with aramid yarn as the primary strength member and a polyethylene sheath for overall protection. Unless otherwise specified on the Plans or by the Contract Specifications, the cable shall have a minimum 36 fibers, with 12 fibers per tube.

82-17(A) Overview Of Fiber Optic Cable Plant
This Section 82-17(A) is intended to provide an overview for projects where fiber optic cable is to be installed. In case of conflicts, the Plans, the Contract Specifications, and all other provisions of these Standard Specifications shall take precedence over this overview in the event of any conflicts.

For the purposes of testing, all fiber strands terminated at the splice vault shall be spliced into pigtails terminated with SC connectors. These pigtails shall be a minimum of 36 inches in length. These pigtail connections shall be utilized to test the fiber optic cable plant to be installed as a part of this project. In addition, all data receiver and other fiber optic electronics shall be tested at this point prior to connection to the control center by others.

The following is a glossary of terms, which are subsequently utilized in these specifications.

<u>Breakout:</u> A "breakout" cable shall be produced by (1) removing the jacket just beyond the last tie-wrap point, (2) exposing 3 to 6 feet of the cable buffers, aramid strength yarn and central fiberglass strength member, and (3) cutting the aramid yarn, central strength member and the buffer tubes to exposes the individual glass fibers for spicing or connection to the appropriate device.

<u>Connector:</u> A mechanical device used to align and join two (2) fibers together to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (patch panel).

Connectorized: A term that describes the termination point of a fiber after connectors have been affixed.

Couplers: Couplers are devices which mate two (2) fiber optic connectors to facilitate the transition of optical light signals from one connector into another. Couplers may also be referred to as: adapters, feed-thrus, and barrels. They are normally located within FDUs mounted in panels. They may also be used unmounted, to join two (2) simplex fiber runs.

EIA: Stands for Electronic Industries Association

Fiber Distribution Unit (FDU): A combination of the Connector Module Housing (CMH) and the Splice Module Housing (SMH) in the same enclosure.

Jumper: A short fiber optic that has connectors installed on both ends, and is used for connection with a FDF.

Light Source: A transportable piece of fiber optic test equipment that, when coupled with a power meter, is used to perform end-to-end attenuation testing. This device contains a stabilized light source operating at the designed wavelength of the system under test. It also couples light from the sources into the fiber to be received at the far end by the receiver.

Link: A passive section of the system, the ends of which are to be connected to active components. A link may include splices and couplers.

Mechanical Splice: A device that permanently joins fiber ends to identical or similar fibers. Mechanical splices are not to be permanently utilized on any project.

Optical Time Domain Reflectometer (OTDR): A piece of fiber optic test equipment similar in appearance to an oscilloscope that is used to measure the total amount of power loss between two (2) points. This test instrument provides a visual and printed display of the relative location of system components such as fiber sections, splices and connectors as well as the losses that are attributed to each component.

Patchcord: A short jumper.

Pigtail: Relatively short length of fiber optic cable that is connectorized on only one (1) end.

Power Meter: A transportable piece of fiber optic test equipment that, when coupled with a light source, is used to perform end-to-end attenuation testing. It contains a detector that is sensitive to light at the designated wavelength of the system under test. Its display indicates the amount of power injected by the light source that arrives at the receiving end of the link.

Segment: A section of fiber optic cable that is not connected to any active device and may or may not have splices per the design.

Splice Closure: A container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from multiple locations. The container is environmentally sealed to protect the fibers.

Splice Module Housing (SMH): The SMH stores splice trays as well as pigtails and short cable lengths.

Splice Tray: A container used to organize and protect spliced fibers.

Splice Vault: A box with a maximum inside clearance which is used to house splice closures.

Storage Cabinet: Designed for holding excess cable slice for protection. The storage cabinet allows the user flexibility in equipment location and the ability to pull cable back for re-splicing.

82-17(B) Single Mode Fiber Optic Outside Plant Cable

1. General
   Unless otherwise shown on the Plans or specified in the Contract Specifications, trunk fiber optic cable shall be all dielectric central membrane, gel filled (or tape water blocked), duct type, loose tube and contain strands of single mode (SM) dual-window (1310 nm and 1550 nm) fibers as shown on the Plans, specified in the Contract Specifications, and in conformance with these special provisions. The Contractor at his option and expense may provide cables with additional fibers. The cable shall comply with all the requirements of the United States Department of Agriculture Rural Electrification Administration Specifications REA-PE-90.

2. Quality Assurance
   All work and material described in this section shall meet or exceed the applicable provisions of the following documents:

   CFR 1755.900, RUS Specification for Filled Fiber Optic Cables
   ANSI, C8.47-1983, American National Standard for Polyolefin-insulated Thermoplastic Jacketed Communication Cables.
   EIA-455-27A, Method of Measuring (Uncoated) Diameter of Optical Waveguide Fibers.
   EIA-455-28B, Method for Measuring Tensile Failure Point of Optical Waveguide Fibers.
   EIA/TIA-455-82A, Water Penetration Test
   EIA-455-95, Absolute Optical Power Test for Optical Fibers and Cables
   EIA-455-103, Buffered Fiber Bend Test
   EIA-359-A-1, Special Colors
   General Fiber Characteristics

Single mode fibers within the finished cable shall meet the requirements in the following table:

Fiber Characteristics Table	
Parameters	SM
Type	Step Index
Core Diameter	8.3 μm (nominal)
Cladding Non-circulatory	125 μm ± 1.75 μm
Core to Cladding Offset	< 0.8 μm
Coating Diameter	250 μm ± 15 μm
Cladding Non-Circularity Defined as: [1-(min. cladding Dia / max. cladding dia.)] x100	< 1.0%
Proof/Tensile Test	3,500 kg/square mm, min.
Attenuation	

Fiber Characteristics Table	
Parameters	SM
@ 1,300 nm (MM)/1310 nm (SM) @ 1,550 nm	≤ .04 dB/km ≤ 0.3 dB/km
Attenuation at the Water Peak	≤ 2.1 dB/km @ 1383 + 3nm
Chromatic Dispersion Zero Dispersion Wavelength Zero dispersion Slope	 1301 to 1321.5 nm ≤ 0.092 ps/(nm^{2*}km)
Maximum Dispersion	3.3 ps/(nm*km) for 1285 – 1330 nm < 18 ps/nm*km) for 1550
Cut-Off Wavelength	< 1,260 nm
Mode Field Diameter (Peterman II)	9.3 ± 0.5 μm 1t 1300 nm 10.5 ± 1.0 μm at 1550 nm

3. Color Coding
   In buffer tubes containing multiple fibers, each fiber shall be distinguishable from others in the same tube by means of color-coding. The colors shall be targeted in accordance with the Munsell color shades and shall meet EIA/TIA-598 "Color Coding of Fiber Optic Cables." The color formulation shall be compatible with the fiber coating and the buffer tube filling compound and be heat stable. It shall not fade or smear or be susceptible to migration and it shall not affect the transmissions characteristics of the optical fibers and shall not cause fibers to stick together.

4. Cable Construction
   Buffer tubes - The loose tubes shall provide clearance between the fibers and the inside of the tube to allow for thermal expansion without restraining the fiber. The fibers shall be loose or suspended within the tubes. The fibers shall not adhere to the inside of the buffer tube.

   The loose buffer tubes shall be extruded from material having a coefficient of friction sufficiently low to allow the fiber free movement. Buffer tubes shall be made of tough abrasion resistance material to provide mechanical and environmental protection of the fibers yet designed to permit safe intentional "scoring" and breakout entry without jeopardizing the internal fibers.

   Buffer tube filling compound shall be homogenous hydrocarbon-based gel (with anti-oxidant additives) USRD to prevent water intrusion and migration. The filling compound shall be non-toxic and dermatological safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscope and electrically non-conductive. The filling compound shall be free from dirt and foreign matter and shall be readily removable with conventional non-toxic solvents. Buffer tubes shall be stranded around a central member by the reverse oscillation stranding process.

   Central Member - The central member which functions as an anti-buckling element shall be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers. A linear overcoat of Low Density Polyethylene shall be applied to the central member of the main truck fiber cable to achieve the optimum diameter to provide the proper spacing between buffer tubes during stranding.

Filler Rods - Fillers may be included in the cable to lend symmetry to the cable cross-section where needed. Filler rods shall be solid medium or high-density polyethylene. The diameter of filler rods shall be the same as the outer diameter of the buffer tubes.

Stranding - Completed buffer tubes shall be stranded around the over-coated central member using stranding methods, lay lengths and positioning such that the cable shall meet mechanical, environmental and performance specifications. A polyester binding shall be applied over the stranded buffer tubes to hold them in place. Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dialectic with low shrinkage.

Core and Cable Flooding - The cable core interstices shall be filled with a polyolefin based compound to prevent water ingress and migration. The flooding compound shall be homogeneous, free from dirt and other foreign matter, non-hygroscopic, electrically non-conductive, non-nutritive to fungus and readily removable. The compound shall be free from dirt and foreign matter and shall be readily removable with conventional non-toxic solvents. A water blocking tape can be substituted for a filling compound.

Tensile Strength Member - Tensile strength shall be provided by high tensile strength aramid yarns and fiberglass, which shall be helically stranded evenly around the cable core.

Outer jacket - The outer jacket material shall be a medium density polyethylene (MDPE) conforming to ASTM D1248. Type II, Class C, Category 4 or 5, Grade J4. The light absorption coefficient, when measured in accordance with ASTM D3349, shall be a minimum of 400 at a wavelength of 375 nm. The jacket shall be free from holes, splits, and blisters with a total minimum jacket thickness of 40 ± 5 mils.

Jacketing material shall be applied directly over the tensile strength members and flooding compound and shall not adhere to the armored strength material. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus. The outer jacket or sheath shall be marked with the manufacturer's name, the words "Fiber Optic Cable", date of manufacturer, sequential meter markers, strand count and type of fiber optic strand. The markings shall be repeated every meter (39 inches). The actual length of the cable shall be within 0 ± 1 percent of the length marking. The marking shall be in a contrasting color to the cable jacket. The height of the marking shall be approximately 3 mm (0.12 inch).

The cable shall contain at least one (1) ripcord under the inner sheath for easy sheath removal.

The finished cable shall be capable of withstanding a pulling tension of 2700 N (272.16 kg), minimum.

5. Cable Performance
   General - The fiber optic cable shall withstand water penetration when tested with 1 meter (39 inches) static head or equivalent continuous pressure applied at one (1) end of a 1 meter (39 inches) length of filled cable for one (1) hour. No water shall leak through the open cable

end. Testing shall be done in accordance with EIA-455-82B, "Fluid Penetration Test for Filled Fiber Optic Cable".

The cable shall exhibit no flow (drop or leak) at 80°C. The weight of any compound that drips from the sample shall be less than 0.05 grams (0.002 ounce). A representative sample of cable shall be tested in accordance with EIA-455-81A, "Compound Flow (Drip) Test for Filled Fiber Optic Cable". The test sample shall be prepared in accordance with Method A.

Crush resistance of the finished fiber optic cables shall be 220 N/cm applied uniformly over the length of the cable without showing evidence of cracking or splitting when tested in accordance with EIA-455-25A, "Repeated Impact Testing of Fiber Cables and Cable Assemblies". The average increase in attenuation for the fibers shall be < 0.10 dB at 1550 nm (single-mode) for a cable subjected to this load. The cable shall not exhibit any measurable increase in attenuation after removal of load. Testing shall be in accordance with EIA-455-41A; "Compressive Loading Resistance of Fiber Optic Cable" except that load shall be applied at the rate of 3 mm to 20 mm (0.12"-0.79") per minute and maintained for ten (10) minutes.

The cable shall withstand twenty-five (25) cycles of mechanical flexing at a rate of 30 ± 1 Cycles/minute. The average increase in attenuation for the fibers shall be <0.10 dB at 1550 nm (single-mode) at the completion of the test. Outer cable jacket cracking or splitting observed under 10X magnification shall constitute failure. The test shall be conducted in accordance with EIA-455-104A "Fiber Optic Cable Cyclic Flexing Test", except that the sheave diameter shall be a maximum diameter of 20X and the cable OD. The cable shall be tested in accordance with the Test Conditions 1 and III of the EIA-455.

The cable shall withstand a tensile load of 2700 N (272.16 kg) without exhibiting an average increase in attenuation of greater than 0.10 dB (single-mode). The test shall be conducted in accordance with EIA-455-33, "Fiber Optic Cable Tensile Loading and Bending Test," using a maximum mandrel and sheath diameter of 560 mm. The load shall be applied for one (1) hour in Test Condition II of the EIA-455 procedure.

Quality Assurance - All optical fibers shall be proof tested by the fiber optic cable manufacturer at a minimum load of 3,500 kg/mm2. Documentation of factory results shall be provided to the Engineer prior to shipping.

All optical fibers shall be attenuation tested by the manufacturer in conformance with Section 82-18, "Fiber Optic Testing." The attenuation of each fiber shall be provided with each cable reel.

Packing and Shipping-The completed cable shall be packaged for shipment on lagged wooden reels. The cable and reel shall be wrapped in water-resistant covering. Each end of the cable shall be securely fastened to the reel to prevent the cable from coming loose during transport. Two meters (6.6') of cable length on each end of the cable shall be assessable for testing. Both ends of the cable shall be sealed to prevent the ingress of moisture.

Each cable reel shall have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, the Contractor's name, the contract number, and the reel number. A shipping record shall be included in an attached weatherproof envelope showing the above information and shall include the date of

manufacture, cable characteristics (size, attenuation, bandwidth, etc.,) cable information number and any other pertinent information.

The diameter of the reel shall be at least 30X the diameter of the cable. The fiber optic shall be in one (1) continuous length per reel with no factory splices in the fiber. Each reel shall be marked to indicate the direction the reel should be rolled to prevent loosening of the cable.

82-18 Fiber Optic Cable Testing

For cable testing, see the testing section in Section 82-26, "Fiber Optic Testing."

82-19 Fiber Optic Pig Tail Unit

Where shown on the Plans or specified in the Contract Specifications, pigtail units shall be composed of six (6) pre-connectorized fiber optic pigtails. All optic fibers shown on the plans to be connectorized shall be terminated with a FC/SC Ultra Polish type nickel-plated zinc bayonet, zircona ceramic tip, keyed connector. All cables shall use the same connectors. The connector shall not require a mechanical splice to a factory polished tip. All connectors must be pre-connectorized with pigtails that meet the fiber specifications in these specifications. The pigtail unit shall be composed of 6-900 micron color-coded pigtails.

The surface of the fiber end installed in a connector shall be free of scratches, pits and chips at 200X. No index matching fluids, gels or anti-reflection coatings shall be applied to the end of the fiber. The connectors shall conform to the following:

(a) Insertion Loss: 0.25 dB typical, 0.4 dB Maximum.
(b) Reflectance: Less than –50 dB at 1310 nm measured with a back reflection meter.
(c) Optical Fiber Nominal Outside Diameter: 125 micrometers.
(d) Tensile Strength: Less than 0.2 dB change, based on a 10 kg load without adhesive.
(e) Temperature Cycling: Less than 0.2 dB change, based on -40°C to +80°C, 100 cycles.
(f) Humidity: Less than 0.2 dB change, 60°C at 95% relative humidity for 500 hours.
(g) Durability: Less than 0.2 dB change per 1000 insertions, cleaned every 25th insertion.
(h) Undercut/protrusion ± 50 nm.
(i) Apex offset less than 50 mm.
(j) Connectorized fibers shall be clearly labeled using a labeling convention approved by the Engineer.

82-20 Splicing

All permanent fiber optic cable splices shall be the fusion type and shall not exceed 0.15 dB loss per splice. Splicing of fiber optics cables shall not be permitted except in emergency situations and with prior approval of the Engineer. The field splices shall connect the fibers of two (2) or more fiber optic lengths together as indicated on the conductor schedules. These splices shall be placed in a splice tray and these tray(s) shall then be placed in the splice enclosure.

The termination splices shall connect the fiber optic cable span ends with pigtails. The termination splices shall be placed in a splice tray. The individual fibers shall be looped one (1) full turn within the splice tray to avoid micro bending. A 2 inch minimum bend radius shall be maintained during installation and after final assembly in the optical fiber splice tray. Each bare fiber shall be individually restrained in a splice tray. The optic fibers in buffer tubes and the placement of the bare optical fibers in the splice tray shall be such that there is no discernable tensile force on the optical fiber.

82-21 Splice Enclosures
The fiber optic field splices shall be enclosed in splice closures, which shall be waterproof, rodent proof and re-enterable. The enclosures shall have sufficient capacity to splice the maximum number of fibers specified on the conductor schedule for each location plus an additional twenty (20%) percent spare capacity. The splice enclosure shall be complete with splice organizer trays, brackets, plugs, clips, cable ties, seals and sealants as needed. The splice enclosure shall be suitable for pull box installation, as specified. The splice enclosure shall contain splice organizer trays.

A splice enclosure shall be provided at all locations identified on the conductor schedule. If the Contractor requires additional splice enclosures to support the pulling plan, these enclosures shall be provided and installed at no additional cost to the City.

82-22 Connectors
Fiber optic connectors shall be SC type for single mode applications.

The SC connector operating temperature range shall be -40°F to +176°F. Insertion loss shall not exceed 0.4 dB and the return reflection loss on single mode connectors shall be at least 40 dB. Connection durability shall be less than 0.2 dB change per 1000 mating cycles. All terminations shall provide a minimum 50 lb pull out strength. Factory test results shall be documented and submitted to the Engineer prior to installing any of the connectors.

Field termination shall be limited to splicing of adjoining trunk cable ends and pigtail breakouts. The pigtails shall utilize factory installed SC connectors.

82-23 Passive Cable Assemblies And Components
Fiber optic assemblies and components shall be compatible components, designed for the purpose intended, and factory manufactured by a company regularly engaged in the production of material for the fiber optic industry. All components or assemblies shall be first class non-corroding, with a design life of at least twenty (20) years. All components or assemblies of the same type shall be from the same Manufacturer.

82-24 Warning Tape
Warning tape shall be provided and placed in the trench over conduits which contain or are to contain fiber optic cable as shown on the plans. The warning tape shall be 4" wide with bold printed black letters of approximately 0.75" on bright orange color background, and contain the printed warning "CAUTION BURIED FIBER OPTIC CABLE" repeated at approximately 30" intervals. The printed warning shall be non-erasable and shall be rated to last with the tape for a minimum of forty (40) years. Warning tape shall be Condux International, Inc.; Allen System, Inc.; Reff Industries, Inc.; or approved equal.

The construction of the warning tape shall be such that it will not delaminate when it is wet. It shall be resistant to insects, acid, alkaline and other corrosive elements in the soil. It shall have a minimum of 120 lb tensile strength per 4" wide strip and shall have a minimum of seven hundred (700) percent elongation before breakage.

82-25 Slurry Cement Backfill
Where shown on the Plans or specified in the Contract Specifications, or required by the provisions of Section 8-15, "Utility and Non-Street Facilities; Potholing," slurry cement backfill for the installation of conduits that will contain fiber optic cable shall be 2-sack sand/cement slurry conforming to Section 19-3.062, "Slurry Cement Backfill," of the State Standard Specifications.

82-26 Fiber Optic Testing

82-26(A) General

Prior to arrival of the cable, the Contractor shall provide detailed test procedures for all field testing to the Engineer. The procedures shall include the tests involved and how the tests are to be conducted. These tests plans shall be subject to the approval of the Engineer.

The active components shall be tested by the Contractor after installation. The Contractor shall provide all personnel, equipment, instrumentation and materials necessary to perform all testing. The Engineer shall be notified in writing a minimum of two (2) working days prior to all field tests. The notification shall include the exact location of the system to be tested.

Documentation of all tests results shall be provided to the Engineer for approval within two (2) working days after the tests involved. The Contractors attention is directed Section 82-26 (G), "System Testing and Documentation," regarding the requirements for recording test results.

Attenuation tests shall be performed with an OTDR capable of recording and displaying anomalies of 0.2 dB as a minimum. Single mode fibers (SM) shall be tested at 1310 nm and 1550 nm. The OTDR shall have a printer capable of producing a verifying test trace with fiber identification as shown in the sample "Link Loss Budget Work Sheet", numerical loss values, the date and the operator's name. It shall also have a DOS based 3.5 inch disk recording capability that has associated software to do comparisons and reproductions on 8.5 inch x 11 inch paper, via personal computer.

82-26(B) Factory Testing

Verification of the fiber specifications as listed in the Fiber Characteristics Table shall be supplied by the Manufacturer with the appropriate documentation. After cabling, before shipment but while on shipping reel, one hundred (100%) percent of all fibers shall be tested for attenuation. Copies of the results shall be (1) maintained on file at the Contractor's, Manufacturer's and Owner's place of business with a file identification number for a minimum of ten (10) years, (2) attached to the cable reel in a waterproof pouch, and (3) submitted to the Contractor and to the Engineer prior to the delivery of the cable to the jobsite.

82-26(C) Arrival On Site

The cable and reel shall be physically inspected by the Contractor on delivery for damage or any other potential defects. The Contractor shall not install any damaged or defective cable. The contractor shall be ultimately responsible for furnishing a fully functional system free from damage or defects.

82-26(D) After Cable Installation

After the fiber optic cable has been pulled and terminated, one hundred (100) percent of all fibers shall be tested with the OTDR for attenuation. Test results shall be recorded, dated, compared and filed with the previous copies of these tests. Copies of traces and test results shall be submitted to the Engineer for approval. If the OTDR test results are unsatisfactory, the fiber optic cable segment will be unacceptable. The unsatisfactory segment of cable shall be replaced with a new segment, without additional splices, at the Contractor's expense. The new segment of cable shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer for approval.

82-26(E) Outdoor Splices

At the conclusion of all outdoor splices at one (1) location, all splices shall be tested with the OTDR. Splice segments shall be tested at 1310 nm and at 1550 nm. Individual fusion splice losses shall not exceed 0.07 dB. Measurement results shall be recorded, dated, validated by the OTDR trace printout

and filed with the records of the respective cable runs. Copies of traces and test results shall be submitted to the Engineer. If the OTDR test results are unsatisfactory, the splice shall be unacceptable. The unsatisfactory splice shall be replaced at the Contractor's expense. The new splice shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer for approval.

82-26(F) System Verification At Completion

OTDR Testing
Once the passive cabling system has been installed and is ready for activation, one hundred (100) percent of the fiber links shall be tested with the OTDR for attenuation. Test results shall be recorded, dated, compared and filed with previous copies. Copies of traces and test results shall be submitted to the Engineer for approval. If the OTDR test results are unsatisfactory the link shall be replaced at the Contractor's expense. The new link shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer for approval.

Installed System Link Loss Budget
The Link Loss Budget Worksheet shall be completed for each service point, as defined in the conductor schedules, using the data gathered throughout the installation process. The completed worksheets shall be included as part of the system documentation and in the As-Built Plans. Refer to "As-Built Plans" in these specifications for additional requirements.

The total connector losses shall be calculated by the Contractor by summing the individual attenuation values for each connector pair in the path, excluding the transmitter and the receiver connectors.

The total splice losses shall be calculated by the Contractor by summing the individual attenuation values for each splice in the link.

The total of other losses shall be calculated by summing the individual attenuation values for each component in the link not previously addressed. These items may include, but are not limited to, couplers, splitters, routers and switches.

The Total System Loss shall be recorded on the Link Loss Budget Worksheet.

Test Failures
If during any of these system verification tests, the results prove to be unsatisfactory, the fiber optic cable and or defective splice enclosures will not be accepted. The unsatisfactory components shall be replaced at the Contractor's expense. The new segment of cable shall undergo the same testing procedure to determine acceptability. Copies of the test results shall be submitted to the Engineer for approval. The removal and replacement of a segment of cable shall be interrupted as the removal and replacement of a single contiguous length of cable connecting two (2) splices, two (2) connectors, or a splice and a connector. The removal of only one small section containing the failure and therefor introducing new unplanned splices will not be allowed.

All costs for fiber optic testing shall be included in and incidental to the bid cost for the item tested. There will be no additional payments for testing of any project component or service.

82-26(G) System Testing And Documentation

A. Description

The system testing and documentation shall cover pre-installation testing, subsystem testing, data link testing, physical inspection, functional testing, performance testing, final acceptance and system documentation is required to validate the operation performance of the system and described elsewhere in these special provisions.

B. Test Plan

The Contractor shall develop and submit an installation and test plan to the Engineer within twenty (20) working days of the start of this contract. The test and installation plan shall detail the method of installation and all testing for all material, equipment, and cable and the associated schedule of activities, based on these special provisions, plans, the manufacturer's recommended test procedures, and industry standard practices. One (1) copy of the test plan shall be submitted to the Engineer for approval. The Engineer will review then approve or disapprove of the plan within two (2) weeks. If the Engineer rejects the test plan, the Contractor shall submit a revised test plan within five (5) working days for review and approval by the Engineer. The tests shall quantitatively demonstrate that the design and production of material and equipment meet the requirements of these special provisions and plans. The Contractor shall submit all test results, including results of failed tests or re-tests, shall be submitted and delivered to the Engineer and a copy placed with the equipment at the site. All test equipment shall be supplied by the Contractor. All testing shall be done in the presence of the project manager and signed off by the project manager.

The Contractor shall notify the Engineer of his intent to proceed with functional and subsystem testing forty-eight (48) hours prior to commencement of each test. Full environmental conditions shall be tested as part of the functional tests for field equipment. Subsystem testing and inspections shall include visual inspection for damaged or in correct installation, adjustments and alignment, and measurement of parameters and operating conditions.

C. Pre-Installation Testing

Pre-installation testing shall include testing of all material, equipment and cables in a laboratory environment prior to the delivery to the site. Use of laboratory facilities, shall be arranged by the Contractor. The tests shall either be conducted at the equipment manufacturer's premises or at a laboratory arranged by the Contractor.

All material, except test equipment and special tools, shall be bench tested in accordance with the following paragraphs, which include those items described elsewhere requiring pre-installation testing for each individual item where applicable. All active equipment shall be connected to normal operating power, energized and subjected to normal operating conditions for a continuous period of time in the laboratory of not less than forty-eight (48) hours. Functional testing shall be performed by the manufacturer on all material prior to delivery to the site. The functional tests shall be performed in accordance with an approved test plan. Any material or equipment that fails to meet the requirements of the contract shall be repaired or replaced and the test shall be repeated until satisfactory. All functional test results, including results of failed tests or re-tests, shall be submitted and delivered with all material and equipment delivered to the site.

Full performance tests shall be performed by the manufacturer or by the Contractor on not less than five (5) percent or at least one (1) unit of material selected at random from the normal production run. The full performance test shall be performed in accordance with a test plan developed by the Contractor and approved by the Engineer.

D. Subsystem Testing

Subsystem testing shall encompass the testing of all material, equipment and cable after installation, but prior to acceptance tests. These tests shall be done in accordance with the performance testing called out under each individual item in these special provisions.

Equipment and hardware shall be installed in accordance with the plans and special provisions. All material, equipment and cable shall be tested after installation at the site. Subsystem testing and inspections shall include visual inspection for damaged or incorrect installation, adjustments and alignment, and measurement of parameters and operating conditions. The Contractor shall notify the Engineer of his intent to proceed with subsystem testing forty-eight (48) hours prior to commencement of each test.

Installation documentation and test results shall be provided for all material, equipment and cable prior to commencement of accepted tests. Installation documentation shall be in accordance with these special provisions and shall include the following as appropriate:

Model, part number and serial number for all material and equipment.
Test equipment model number, serial number, settings, and date of last calibration.
All strap and switch settings
Records of all adjustments and levels.
Alignment measurements.
Identification of interconnections.
All factory, laboratory and site test results.

E. Data Link Testing

The data link testing shall be conducted after the Contractor submits a test plan and receives approval from the Engineer, based on these special provisions, plans and the manufacturer recommended test procedures for the equipment involved. Measurements shall be made from the baseband-in to baseband-out connections. A data communications link shall include a data transmitter, data receiver, interconnecting optical fiber, connectors and power supplies. The data link is to provide point-to-point transmission and reception of a full motion NTSC baseband signal using an optical fiber as the transmission medium.

Each data link in the communications system shall be tested with a data test signal at the transmitter input. The Contractor shall perform all level adjustments and alignments required on the data link in order for it to operate in accordance with these special provisions. If any data link fails to meet the performance requirements, the Contractor shall take all steps necessary to restore the failed link to the required performance.

Each data link in the communications system shall be tested for qualitative performance and connected to the BNC connector of the data link transmitter. The Contractor shall measure and record the received optical power at the optical connector of the data receiver from the data transmitter under test using a ninety (90) percent APL (Average picture level) flat field input to the transmitter. The Contractor shall measure, record and tabulate a receiver's dynamic range at the optical connector of the data receiver from the data transmitter under test using a ninety (90) percent APL flat field input to the transmitter. To do this, the measured optical attenuation of the fiber being used shall be increased to the point at which the data test just begins to show a 3 dB degradation of the data signal to noise ratio in accordance with EIA 25-C data test procedures. The optical receive power into the data receiver shall be measured and recorded. Then the optical attenuation shall be decreased until the data test set once again shows degradation of the data and registers errors. At no time shall the optical power into the receiver exceed the manufacturer's

specified saturation level. The optical receive level shall once again be measured and recorded. These minimum and maximum receive levels define the data receiver's dynamic range and shall meet or exceed the specifications as specified elsewhere under these special provisions. This measurement shall be repeated for each data link. The Engineer shall approve the data test. The Contractor shall measure and record the baseband data output level from the data receiver under test. This measurement shall be repeated for each data link.

The Contractor shall measure, record and tabulate the receiver's dynamic range at the optical connector of the data receiver from the data transceiver under test. To do this, the measured optical attenuation of the fiber being used shall be increased to the point at which the data test set just beings to show a 3 dB degradation of the data signal to noise ratio in accordance with EIA 250-C data test procedures. The optical receive power into the data receiver shall be measured and recorded. Then the optical attenuation shall be decreased until the data test set once again shows degradation of the data and registers errors. At no time shall the optical power into the receiver exceed the manufacturer's specified saturation level. The optical receive level shall once again be measured and recorded. These minimum and maximum receive level define the data receiver's dynamic range and shall meet or exceed the specifications elsewhere under these specifications. This measurement shall be repeated for each data link. The Engineer shall approve the data test. The Contractor shall measure, record and demonstrate that the performance meet or exceed the specified EIA/TIA 250-C requirements listed below:

1. Differential gain – 5%
2. Differential phase – less than or equal to 3
3. Chrominance to luminance delay inequality - ± 33 ns
4. Amplitude Vs frequency characteristics – (See figure 3 of ETA/TIA-250-C)
5. Frequency response characteristic
6. Signal to noise ratio – 60 dB
7. Signal to low frequency noise ratio – 48 dB
8. Signal to periodic noise
9. Output signal level – 1 Volt Peak to Peak

F. Acceptance Testing

The acceptance testing shall be conducted in accordance with the approved test plan. The acceptance testing shall include conducting acceptance tests and subsequent re-tests, and documentation of the test results.

Final accepted tests shall be conducted after the site and subsystem test results have been reviewed and accepted by the Engineer. These tests include the complete system in normal operations. The test plan shall address the full testing requirements of the specifications. The test plan shall detail all tests to be performed, the test results that are expected and the test schedule. The acceptance test plan shall include the following major test and acceptance categories:

1. Physical inspection
2. Functional tests
3. Performance tests.

The contractor shall test the communication system according to the approved acceptance test plan and shall provide all test equipment, labor and ancillary items required to perform the testing. The test equipment shall be certified to be calibrated to the manufacturer's specifications. The model and part numbers and date of last calibration of all test equipment shall be included with the test results.

Acceptance testing shall not commence until all material required by these special provisions and plans are delivered, installed and aligned and the Engineer has approved all production test and site test documentation and results.

All acceptance test results shall be fully documented and such documentation provided as a condition of acceptance.

G. Physical Inspection
The Contractor can provide documentation to prove delivery of all material, equipment, cable and documentation. If any material or documentation is outstanding or have been replaced under pre-acceptance warranty a physical inspection and documentation shall be provided for this material. The physical inspection shall consist of inspecting all insulated material to ensure workmanship satisfies the specified requirements.

H. Functional Tests
The Contractor shall test all system functions to demonstrate that all data circuits, and all equipment satisfy the functional requirement of the specifications.

The connectivity of each data channel shall be demonstrated. The Contractor shall document all functional test results. In the event that any aspect of the functional tests are determined by the Engineer to have failed, the Contractor shall cease all acceptance testing and determine the cause of the failure and make repairs to the satisfaction of the Engineer. Acceptance testing shall, at the discretion of the Engineer, be repeated beginning from the start of functional tests.

I. Performance Tests
The Contractor shall conduct operational performance tests on the following:

All data/control circuits operational from the data switch system to the system elements located in the field.

Response to alarm inputs.

System diagnostics.

Data tests shall satisfy the end-to-end performance requirements under normal operating conditions. The Contractor shall test the data subsystem and record the test results.

The data signal to noise shall be measured according to EIA/TIA-250-C. The data signal to noise ratio shall be measured and recorded with both the data input reference and with suitable data test equipment providing the data reference signal. When the source is the test equipment, the data signal to noise ratio shall be greater than 47 dB.

Adjustments shall be calculated to account for any deviation in output level resulting from the variable light conditions, the automatic iris and associated automatic gain control. The resulting data signal to noise ratio shall be recorded.

The data signal to low frequency noise ratio shall be measured according to EIA/TIA-250-C. The resulting data signal to low frequency noise ratio shall be greater than 39 dB. If an AGC circuit does not allow measurement as per EIA/TIA-250-C, Contractor shall submit an alternative test plan for approval.

The data signal to periodic noise ratio shall be measured according to EIA/TIA-250-C. The resulting data signal to periodic noise ratio shall be greater than 52 dB.

If any circuit or element fails to satisfy the specified performance requirements the Contractor shall determine the cause and correct the failure to the satisfaction of the Engineer. The full performance tests shall be repeated under operating conditions as determined by the Engineer.

J. System Documentation

The Contractor shall submit a draft copy of all documentation for review and approval prior to production of documentation. The Engineer will review and approve or reject the draft documentation within four (4) weeks of receipt.

The Contractor shall modify the documentation if required and submit provisional documentation. The Engineer will approve or reject the provisional documentation within three (3) weeks of receipt. The Contractor shall arrange for re-submission in a timely manner to meet the schedule in the case that the documents are rejected. Draft documentation shall be submitted eight (8) weeks prior to the start of installation. The draft documentation shall show the general approach in preparing the final manuals.

Upon approval of the draft documentation provisional documentation shall be supplied three (3) weeks prior to the start of site testing. The provisional documentation shall be of the same format as the final manuals but with temporary insertion for items that cannot be finalized until the system is completed tested and accepted. Final documentation shall be submitted no later than four (4) weeks after completion of the acceptance tests and shall incorporate all comments made during the approval stages. The Contractor shall be responsible for all delay caused by non-compliance to the specified requirements.

Final documentation shall be approved prior to its production. Ten (10) copies of all final documents shall be delivered. The copies shall be 8 ½ inch x 11 inch paper and bound in three-ring hard-covered binders complete with dividers. Also the documentation shall be furnished electronically in "Word" format. System documentation shall be arranged in an operation and maintenance (O&M) manual format providing all the information necessary to operate, maintain and repair the equipment and cable to the lowest module or component level. The operation and maintenance manual shall as a minimum consist of the following subsection as described below:

1. Master Items Index - This shall be the first section of the O & M Manual. This section shall describe the purpose of each manual and brief description to the directory of the manual. It shall also reference equipment manuals as required for additional and support material.

2. Theory of Operation – The manual shall contain a functional description of each element of the system, explaining how each function is being achieved separately and how each element works together to form the complete system.

3. Operations – The manual shall describe how to operate the system and each particular type of equipment. Equipment layout of controls, displays, and all other information required to correctly operate the system and each functional unit shall be provided. Procedures shall also

be provided for initial tune-up of the system and adjustment and checkout required to ensure that the system is functioning within the performance requirements. Warning of special procedures shall be given. The functions land settings of all parameters shall be explained.

4. Corrective Maintenance – The manual shall include fault diagnostic and repair procedures to permit the location and correction of faults to the level of each replaceable module. Procedures shall include alignment and testing of the equipment following repair, the test equipment, tools and the test set up.

5. Preventative Maintenance – The manual shall include a list of all replaceable parts with exact parts description and number and a directory of recommended suppliers with correspondence address, telephone and fax numbers.

6. Parts List – The manual shall include a copy of the results for all the tests that have been conducted for the contract.

7. Test Results – This section shall include a copy of the results for all the tests that have been conducted for the contract.

System schematic drawings shall be provided to identify the type of equipment at each location and the function of all equipment. The drawings shall also show how the system is interconnected. A comprehensive list of cabling and wiring shall be provided to clearly identify the interconnection and labeling.

82-27 Measurement

Unless otherwise specified in the Contract Specifications, Fiber Optic Facilities will be measured as follows:

Single Fiber optic conduit installations will be measured on a lineal foot basis up to the inside face of pullboxes or cabinets or other enclosures. Multiple conduit installations shall be measured as specified in the Contract Specifications.

Measurement of single fiber optic cable installations will be made on a lineal foot basis including excess required at pullboxes or cabinets. Multiple cable installations will be measured as specified in the Contract Specifications.

No measurement of colored concrete backfill, pull tape, couplings, bells, warning tape, tracer wire, pigtail units, splice enclosures, connectors, and other incidental materials, will be made. These will be considered as part of the price paid for conduit or cable installation.

Pullboxes, cabinets, or other enclosures will be measured on an each basis.

Where a bid item is included in the Contract Specifications, testing and documentation of Fiber Optic Cable materials and systems will be measured on a lump sum basis. If no bid item is provided, testing and documentation will be included in the cost of Fiber Optic Cable installation.

Where a bid item is provided therefor, Surface Restoration will be measured as specified in the Contract Specifications. Where no bid item is provided, surface restoration will not be measured and included in the cost of conduit installation.

82-28 Payment

Unless otherwise specified in the Contract Specifications, Fiber Optic Facilities will be paid for as follows:

Single Fiber Optic Conduit installations will be paid for a lineal foot basis. Multiple conduit runs will be paid for as specified in the Contract Specifications. The unit price paid for Fiber Optic Conduit shall include all labor, materials, equipment, and incidentals necessary for a complete conduit system, including excavation, backfill including colored concrete backfill where specified, compaction, deflection testing, pull tape, marker tape, tracer wire, couplings, bells, and all incidentals required for a complete and functional conduit system ready to receive installation of cable.

Single Fiber Optic Cable installations will be paid for a lineal foot basis. Multiple Fiber Optic Cable installations will be paid for as specified in the Contract Specifications. The unit price paid for Fiber Optic Cable shall include all labor, materials, equipment, and incidentals necessary for a complete cable system, splice enclosures, pigtail units, connectors, and all incidentals required for a complete and functional cable system.

Pullboxes, cabinets, or other enclosures shall be paid for per each, which shall include all costs for furnishing and installing complete assemblies with footings and adjacent slab work as required, completing conduit and cable entries, and all incidentals necessary for a complete installation.

Where a bid item is provided therefor, testing and documentation of Fiber Optic Cable materials and systems shall be paid for on a lump sum basis, which shall include all labor, materials, testing or other equipment, and all necessary incidentals to conduct and complete all testing required by these specifications, the Plans, or as directed by the Engineer. Where no bid item is provided therefor, the cost of testing and documentation of Fiber Optic Cable materials and systems shall be included in the price paid for Fiber Optic Cable installation and not paid for separately.

Where a bid item is provided therefor, Surface Restoration will be paid for as specified in the Contract Specifications. Where no bid item is provided, the cost for Surface Restoration shall be included in the price paid for Fiber Optic Conduit or Cable installation.

SECTION 83 - LIGHTING SYSTEMS

83-1 General

The work shall consist of furnishing and installing exterior lighting systems typically associated with landscape features such as parks, trail systems, parking lots, or other exterior public places, but not including lighting systems for public street right of way. Lights generally will be stand alone facilities, connected in groups, and not attached to or mounted on buildings. Lighting systems are to be complete and fully functional, all as shown on the Plans, the Standard Drawings, as specified in the Specifications, and as directed by the Engineer. The work shall include, but not be limited to, furnishing all labor, materials, equipment, and supplies necessary for the installation of lights or lighting systems, electrical conduit, wiring, service panels, foundations for cabinet or lights, and all incidentals related thereto.

In conformance with Section 2-2, "Examination of Site of Work, Plans, Specifications and Contract Forms," the Contractor shall examine carefully the site of work. Submission of a bid shall mean that the Contractor has investigated the site and is satisfied as to the conditions to be encountered, the character, quality, and quantity of work to be performed and materials to be furnished, and the requirements of the Plans and Specifications.

All work called for on the Plans, the Standard Drawings, and as set forth in the Specifications shall be executed in accordance with all applicable governing ordinances, laws, codes and regulations and shall meet all local conditions. Any changes and/or additions in work necessary to comply with ordinances, laws, codes and regulations and/or conditions will be made without additional expense to the City, but such changes shall have the prior written approval of the Engineer.

83-2 Equipment List And Drawings

Where required by the Plans or the Contract Specifications, equipment lists and drawings of electrical equipment and material shall conform to the applicable provisions in Section 86-1.04, "Equipment List and Drawings," of the State Standard Specifications and these Standard Specifications. The equipment list shall give firm delivery dates for materials. In the event these dates cannot be met, the equipment supplier and Contractor shall provide documentary proof of search for alternate sources of supply at least thirty (30) calendar days prior to the stated delivery dates. Such action shall not be justification for granting additional working days but shall be evidence of proceeding to completion in good faith.

83-3 Materials

A. General

In conformance with Section 6, "Control of Materials," any material specified by name and/or model number in the Plans, Standard Drawings, the Specifications shall be deemed to be used for the purpose of identifying the standard of quality and type of materials and insuring the specific use of that material in the construction of the system. If substitution of a material is desired by the Contractor, sufficient descriptive literature and material samples must be furnished to establish the material as an equal substitute. In addition, the Contractor must state his reasons for desiring substitute materials.

B. Regulations and Codes

All electrical equipment and material and its installation shall conform to the current requirements of the latest editions from the following authorities. Where two or more codes conflict, the most restrictive shall apply. Nothing in the Plans or Specifications shall be construed to permit work not conforming to applicable codes.

Occupational Safety and Health Act (OSHA)

National Electrical Code (NEC)

California Code of Regulations (CCR)

Title 8, California Electrical Code

Title 19, Fire and Panic Safety Standard

Title 24, Building Standards

Uniform Building Code

National Fire Code

C. Lights
Lights shall be furnished in the voltage, size, color, type, or model shown on the Plans or specified in the Contract Specifications. Lights shall conform to all applicable codes and regulations.

D. Foundations
Foundations for light standards shall comply with Section 86-2.03, "Foundations," of the State Standard Specifications.

E. Pull Boxes
Pull boxes shall conform to the provisions in Section 86-16, "Pull Boxes" except as follows: Pull boxes shall be No. 5E (with extensions) unless otherwise noted on plans. Pull boxes, covers and extensions shall be precast reinforced concrete, unless otherwise shown on the Plans, Standard Drawings, or specified in the Contract Specifications. Pull box lids shall be lockable unless otherwise noted on the plans.

F. Cabinets, Other Enclosures
All cabinets, service panels, and any other enclosures shall be of the model and type indicated on the Plans, Standard Drawings, or specified in the Contract Specifications.

G. Conduit
Threaded rigid galvanized metal shall be used for all exterior locations above grade or as shown on Plans. Rigid conduit shall be new galvanized threaded, conforming to UL 6. All couplings and connectors shall be threaded. At NEMA 3R locations, conduit shall enter boxes through hubs provided or Meyers type hubs. All rigid steel conduit installed in contact with the earth will have a factory applied PVC outer covering and be installed with the proper tools according to the manufacturer's specifications.

PVC Schedule 40 conduit shall be used at underground locations and below vapor barrier of slabs, and in solid grouted masonry walls where wall entry and exit points are made with rigid galvanized steel. No plastic conduit shall be installed in slab floors or in exposed locations. PVC conduit shall be Type 40 heavy thick wall polyvinyl chloride conduit, Underwriters' Laboratories tested, furnished in 10 foot lengths, conforming to UL 651-77.

PVC coated rigid galvanized conduit: All metallic conduits installed in contact with concrete in contact with earth shall be coated with a minimum 40 Mil PVC (factory applied) coating on all conduit lengths and fittings. The coating shall correspond to ATSM D638-68, D1706, D140-64, and D746-64T Specifications and Federal Test Standard 141, Method 615z. Coating shall be continuous without flaws showing exposed metal. Coating shall extend to the device conduit is terminated to in exposed locations and 12" above grade in unexposed locations.

Where direct horizontal boring is to be utilized, unless otherwise shown on the Plans or specified in the Contract Specifications, electrical conduit shall be SDR 11 HDPE, furnished and installed in conformance with and at the locations shown on the Plans, in conformance with the Contract Specifications, the provisions in these Specifications, and as directed by the Engineer. Conduit shall be smooth wall, direct burial rated and specifically designed for electrical wiring.

H. Tracer wire shall be No. 10 stranded copper with white insulation.

I. Pull Tape shall be flat, woven, polyester, have a minimum pull (tensile) strength of not less than 2,500 lbs., and shall be printed with sequential measurement markings for its full length.

J. Services and Switchboards shall be of the make, model, or type complying with the details shown on the Plans or as specified in the Contract Specifications.

83-4 Permits And Licenses

The Contractor shall comply with the requirements of Section 7-10, "Permits and Licensing." The Contractor will be required to obtain an electrical and any other related permit from the City Building Division prior to beginning any work, and pay all fees related thereto. The contractor must posses all required State licenses and state same on the bid proposal.

83-5 Specialized Inspection

All of the work described herein will be subject to inspections by an Engineering Division inspector and specialized City Building Division inspector, as ordered by the Engineer. Such specialized inspections will be made of all electrical facilities subject to the regulations and codes listed in Section 83-3, Paragraph (B), "Regulations and Codes."

The Contractor shall notify the Engineer at least two (2) working days in advance of any electrical work and also at least two (2) working days in advance of any work done intermittently in order that inspection required by the Electrical Code can be coordinated.

All overtime inspection charges incurred by specialized City Building Division personnel shall be paid by the Contractor when inspection services are required outside of normal working hours. Work requiring inspection before or after the normal 8 hours of a normal working day or taking place on holidays Saturdays and Sundays will be considered overtime inspection. The Contractor will be billed at the standard City hourly overtime rate. Failure to pay the bill will be cause to deduct the amount from monies due the Contractor.

In the event the Contractor schedules an inspection and has not completed the work that is to be inspected or made an effort to do so, the Contractor will be billed at the standard City hourly rate for the cost of time expended by City inspectors in preparing for and making the determination that the work has not been satisfactorily completed to warrant an inspection. If the inspection was scheduled to occur on overtime, a weekend, or holiday, said charge will be calculated at the standard City

overtime/double time rate as applicable. Failure to pay the bill will be cause to deduct the amount from monies due the Contractor.

83-6 Tests, Standards, And Procedures

The tests, standards, or recommended procedures of the following agencies shall relate to all parts of these Standard Specifications and shall be considered a minimum:

American National Standards Institute (ANSI).

Underwriters Laboratories, Inc. (UL).

National Electrical Manufacturers Association (NEMA).

Electrical Testing Laboratories (ETL).

National Fire Protection Association (NFPA).

Insulated Power Cable Engineers Association (IPCEA).

Institute of Electrical and Electronic Engineers (IEEE).

Illumination Engineering Society (IES).

National Electrical Testing Association, Inc. (NETA).

83-7 Design

The objective of the Plans and Contract Specifications (design) is to provide a lighting system which will operate in an efficient, safe, and satisfactory manner. The finished system shall adequately and efficiently illuminate all areas to be covered and shall perform in all respects in conformance with the plans and specifications and to the satisfaction of the Engineer.

The electrical drawings are diagrammatic and do not necessarily show all raceways, wiring, number or types of fittings, offsets, bends or exact locations of items required by the electrical systems. Materials not shown or indicated, which are clearly necessary for proper operation or installation of systems shown, shall be provided at no increase in contract price.

The Contractor shall not willfully install the lighting system facilities as indicated on the Plans when it is obvious in the field that obstructions or other features exist that might not have been considered in the design. Such obstructions or differences should be brought to the attention of the Engineer, in writing, by the Contractor for consideration of adjustment in proposed facility locations, prior to installation of facilities.

83-8 Trenching And Excavation For Conduits And Foundations

Trenching and Excavation shall comply with Section 8-15, Utility and Non-Street Facilities; Potholing," and Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration," relative to trenching and excavating. Excavations shall be open vertical construction, sufficiently wide to provide free working space around the work installed and to provide ample space for backfilling and tamping. In lieu of open trenching for electrical conduit, the Contractor at his option may utilize direct horizontal boring unless determined by the Engineer to unsuitable for a specific application. Direct horizontal boring shall comply with Section 82-8 (A), "Direct Horizontal Boring." In any case, the conduit shall be installed to the lines and grades shown on the Plans.

The use of a vibratory plow or methods other than open vertical trenching will not be allowed without the written approval of the Engineer. To obtain such approval, a field test must be performed, at the proposed site, with the equipment to be used in the presence of the Engineer. The field test is to indicate if the proposed site is favorable to the plowing method. Approval for plowing at one location does not allow the use of plowing at another location. Approval for plowing must be obtained for each location where the use of plowing is proposed. If, at previously approved plowing locations, conditions for plowing become unfavorable as determined by the Engineer, plowing shall be terminated.

Trenches for conduit and equipment shall be cut to required grade lines, and compacted to provide an accurate grade and uniform bearing for the full length of the conduit. When two conduits are to be placed in the same trench, a minimum 4-inch space between conduits must be maintained. Unless otherwise shown on the Plans or specified in the Contract Specifications, the depth of trenches shall be sufficient to provide a minimum of 36" cover above the top of the conduit.

83-9 System Installation

A. The Contractor shall verify and be familiar with the location of existing or proposed electrical supply sources and shall make connections in accordance with applicable codes, the Plans and applicable Standard Drawings, and the Specifications. The electrical meter required for the project will be provided by PG&E. The Contractor shall furnish the meter box, pedestal, footing, electrical panels, all fittings, sweeps, conduit, and all appurtenances required for a complete electrical service.

   The Contractor shall be responsible for providing an electrical service in a service panel in accordance with the Plans and the Contract Specifications. Where lighting systems are to be provided in conjunction with other improvements requiring electrical services such as irrigation controllers or booster pumps, the Contractor shall make provision as shown on the Plans or specified in the Contract Specifications.

B. All circuits shall be identified at the service panel.

C. Wires shall not be taped together inside conduits.

D. Lighting systems installed as a component of a landscape design shall conform to all design and materials specifications on the Plans.

E. Unless otherwise noted on the Plans, security lights in parks or play lots, along trails or walkways, alleys, and in parking or other areas, are to be controlled by time clocks and photo cells, which are to be installed at the control panel as shown on the Plans and according to manufacturer's recommendations. Timers and photocells shall be of type, make and model indicated on the Plans or specified in the Contract Specifications. For most installations, the photo cell should be installed facing north. In larger parks or installations, the security lighting system may be split, having some lights controlled strictly by photocell and some by time clock/photocell. Installation shall follow the Plans for the specific system design specifications.

F. Ornamental or landscape lighting (including low voltage systems) shall also be controlled by a time clock/photocell control. These lights shall have relay switches that are separate from the security lighting system.

G. For maintenance purposes, a test switch that bypasses the photocell is to be installed in the control panel. The switch is to be identified as the "test".

H. Electrical outlets to be furnished at picnic areas as a part of a lighting project, or to be installed at the base of light poles are to be "hot" at all times. No more than two duplex outlet receptacles are to be on a single 20-amp circuit.

I. Each of the above, as well as any other components of the electrical/lighting system are to have individual, labeled circuit breakers (i.e. irrigation controller is not to share a breaker with security lighting).

J. Layout: The Contractor shall be responsible for layout of proposed lighting facilities at the site and any minor adjustments required due to differences between the site and drawings. Any such deviations in layout shall be within the intent of the original drawings and shall be approved by the Engineer. The City will indicate the proposed precise location of the electrical service panels.

K. Grades: Before starting work on the system, the Contractor shall carefully check all grades to ensure the work above and below ground may safely proceed and keep within the specified material depths or finish elevations. If part of an overall landscaping project, work shall be coordinated so that all electrical facilities will be placed at the depth, surface elevation, and location specified for the finished condition.

L. General Installation: Any equipment installed by the Contractor and deemed to be for the use of the City shall be so installed to be readily accessible and quickly operable. Two keys for lockable equipment shall be supplied to the City upon installation.

M. Conduit Clearance: All conduits shall have a minimum clearance of 4 inches from each other. Conduits for electrical facilities shall not be placed in a trench to be shared by other facilities such as irrigation pipe. The spacing between electrical conduit and other parallel facilities shall be as shown on the Plans. Parallel conduits shall not be installed directly over one another.

N. Immediately upon installation of conduit, all openings shall be capped or plugged to prevent the entrance of materials that would obstruct the pipe. Caps shall remain in place until removal is necessary for completion of installation.

O. All electrical conduit traversing paved concrete or hardscaped areas is to be installed in schedule 40 galvanized iron pipe sleeves that are at least 2 inches in diameter larger than the conduit within the sleeve.

P. Joining of conduit: It is the responsibility of the Contractor to be familiar with any and all methods of assembling, joining, and installation of the types of conduit to be used. The Contractor shall strictly adhere to recommendations in the manufacturer's guide. If during any phase of the work, the Contractor or any of the workers are not familiar with the recommended procedures, the Contractor shall arrange with the manufacturer of the particular product for the services of a qualified manufacturer's representative to instruct the workers in the proper recommended procedures.

Q. Pull Tape: Pull tape shall be provided in all conduits. Each end of electrical conduit shall be fitted with an approved, watertight expansion plug with integral provisions for secure attachment of the pull tape. The ends of the tape shall be secured to the expansion plug to ensure that the tape does not draw back into the conduit. The length of pull tape provided in each conduit shall

include a minimum of 72 inches of excess tape in each pullbox or other terminating enclosure. Use approved wire pulling lubricant for pulling #4 AWG and larger wire. Oil or grease is prohibited as a conductor pulling lubricant. All conductors #8 and smaller shall only be pulled by hand.

R. Tracer Wire: Tracer wire shall be installed in all conduit runs, whether conduit is metallic or non-metallic. and shall be installed in compliance with Section 82-10, "Tracer Wire" Tracer wire shall be installed on the outside of all conduit installed, including conduit installed by boring methods.

S. All rocks or other debris shall be removed from conduit trenches. Conduit shall have a firm uniform bearing for the entire length of each conduit to prevent uneven settlement. Pad trenches with soil as necessary to provide uniform bearing surfaces.

T. All changes in the direction of the conduit shall be made with sweeps or appropriate fittings, not by bending.

U. Grounding: Suitable system and system component grounding shall be installed as necessary to provide continuous ground system and approved for use by UL. Ground Rods shall be "Copperweld" or approved equal, ¾ inch diameter, 10 feet long. All grounding conductors shall be copper, sizes not less than that required under CEC requirements, Article 250. All grounding is to be installed per CEC, Article 250.

V. Molded Case Circuit Breakers:
General: Provide factory-assembled, molded case circuit breakers of frame sizes, characteristics, and ratings indicated. Circuit breakers shall be UL listed and meet NEMA Standards Publication AB1. Breakers covered under this specification may be applied in switchboards, panel boards, motor control centers, combination motor starters, and individual enclosures. Circuit breakers shall be manufactured by G.E., Seimans, Cutler Hammer, or Square D.

W. Small Power Secondary Panel Board Breakers: Bolt on construction, Square D, QOB, GE, Seimans, or Cutler Hammer equivalent. Breakers indicated as "GFI" (Ground Fault Interruptive) shall provide UL Class AC 5 milliampere sensitivity ground fault protection integral within the breaker. Single pole GFI breakers shall take no more panel space than a conventional breaker.

X. Color Coding: Color-coding shall be factory applied colors on conductors #10 and smaller. For larger conductors, use phase tape. Color coding shall be strictly adhered to and shall be as follows:

Color coding for 120/208/240-volt systems shall be:

A Phase-Black

B Phase-Red

C Phase-Blue

Neutral - White

Ground – Green

Color coding for 277/480/240-volt system shall be:

A Phase-Brown

B Phase-Orange

C Phase-Yellow

Neutral - Gray

Ground - Green

Color coding utilized shall be noted on electrical "as constructed" drawings and shop drawings to be submitted by the Contractor to the Engineer in conformance with Section 83-16, "As-Constructed Drawings."

The color coding for control circuit wires will be as noted on the Plans or as agreed upon with the Electrical Engineer and will be of a color other than that designated for the phase wires. Where control wires are installed and various colors are used, they shall be noted on the "as constructed" drawings and shop drawings submitted as above provided.

Y. Splices: Splice only in accessible junction or outlet boxes. Splices in conductors #8 and smaller shall be made with Scotchlok connectors. Splices in conductors #6 and larger shall be made with approved pressure connectors. Submit all methods of splicing for approval by the Engineer. Wiring in panel boards, switchboards, and cabinets shall be neatly installed. Wiring shall be grouped, laced or clipped, and fanned out to wiring terminals.

Z. Miscellaneous: In addition to all other requirements for identification and marking of wires, panel boards, and junction boxes, the identification of individual wires terminating in either junction boxes, circuit breakers, terminal strips, or on control devices shall be done by means of waterproof permanent black ink on plastic Brady label.

83-10 Backfill And Compaction, Trenches And Foundations

Backfill and compaction of trenches, potholes, boring and receiving pits, and foundations shall comply with Section 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration."

83-11 Pullbox Installation

When pull box extensions are used, grouting shall be placed between pull box and extension. A layer of roofing paper shall be wrapped around pull box and extension prior to backfilling dirt. Dirt and debris shall be removed from pull box prior to installing conductors. A one inch (1") diameter drain hole shall be provided in the center of the pull box. Grout shall be installed to cover the crushed rock sump bottom of the of the pull box and sloped toward the drain hole. The drain hole shall run through the grout bottom into, and exposing, the rock sump. Contractor's attention is directed to Section 86-2.06C, "Installation and Use," of the State Standard Specifications; conductors shall not be installed prior to grouting the pull box.

The pull box elevation for pull boxes installed in sidewalks, planting areas adjacent to sidewalks or median islands shall be at proposed final grade. Pullbox elevation shall be 0.1' above finished grade for all other areas unless elevation is shown on plans or otherwise directed by the Engineer. Pull boxes installed in median islands for left turn, intermediate, and far detectors shall be placed adjacent to the curb farthest from the left-turn lane.

When pull boxes are placed in dirt and planting areas, a concrete collar shall be constructed around the pull box. The surface elevation of the collar shall match the surface elevation of the pull box and slope away from the pull box at a rate of 1:50 (2% slope). The width of the collar shall be 12" wide and 6" in depth.

On long runs, pull boxes shall be installed at a maximum spacing of 200 feet. Pull boxes shall be required at all conduit change of direction.

The word "LIGHTING" shall be inscribed on all pull box covers except for splice boxes (if used) adjacent to PG&E's service pole. This pull box cover shall be inscribed as indicating "P. G. & E." Pull box covers shall not contain hold-down bolts or holes unless otherwise shown on the Plans or specified in the Contract Specifications.

At completion of all work in pull boxes, an approved ant repellent (Rainbow Insect Control Distributed by Southwest Power, (800) 670-7746 or approved equal) shall be supplied by the Contractor and installed by the City.

83-12 Installation Of Grounding

Grounding systems shall comply with all the codes and ordinances specified. Grounding systems shall provide continuity through the entire electrical system including:

A. Panel board ground buses.

B. All conduit or other raceways.

C. All motors.

D. All lighting fixtures.

E. Grounding terminals of all receptacles.

F. Miscellaneous grounds required by code.

G. Main service grounds

Equipment and raceway bonding procedures shall be rigidly maintained and meet all jurisdictional requirements of codes and regulations. There will be an equipment bond wire in all conduits.

Good, electrically continuous, metal to metal contacts shall be made wherever possible at all panel boxes, pull boxes, etc. Where it is not possible to obtain good contacts, the conduit shall be bonded around the boxes with a #6 B&S gauge, rubber-covered, double braided wire with ground clamps.

Provide a separate grounding conductor in all flexible conduit runs to include watertight flexible conduit with integral grounding straps. Install ground conductors inside conduit with ungrounded conductors. Extend from nearest panel to device being connected.

All new service installations shall be grounded in accordance to code requirements and per the Plans. Isolated transformers, including mini power zones, shall be grounded on the secondary to a ground rod. An existing service will be grounded to a visible ground rod and metal water piping. Check resistance to ground at all locations (new and existing services and transformers). Submit test results and test method to the project Inspector or Engineer of record. If resistance exceeds 25 OHMS, install additional ground rods separated at least 6'-0" until resistance is reduced to 25 OHMS or less (CEC 250-84).

83-13 Installation Of Services And Switchboards
Switchboards shall be installed as indicated on the Plans, in accordance with manufacturer's written instruction, and with recognized industry practices to ensure that switchboards comply with requirements of NEMA and CEC standards, and applicable portions of NECA's "Standard of Installation."

Prior to energizing circuitry, check all accessible connections to manufacturer's torque specifications. Subsequent to wire and cable hook-ups, energize switchboards and demonstrate functioning in accordance with requirements.

All G.F.I. breakers shall be tested and shown to comply with CEC Section 230-95 in accordance with International Electrical Testing Association, Inc. (NETA) standards by a NETA certified independent testing company.

83-14 Surface Restoration
Surface restoration shall conform to Section 19-3.05, "Restoration of Surfaces."

83-15 System Testing
The Contractor shall furnish all labor and test equipment required to fully test the equipment installed as shown on the Plans and as specified in the Specifications, and demonstrate its proper operation, in accordance with the following:

A test must demonstrate that each piece of equipment, outlet, fixture, device, and appurtenance is in sound operating condition and in proper cooperative relation to associate equipment.

Submit complete test reports with the operations and service manual submission.

Any portion of the work, which does not perform satisfactorily, or any defects, which are disclosed by testing, shall be corrected by Contractor at his expense before work will be accepted.

83-16 As-Constructed Drawings
The Contractor shall furnish to the Engineer a complete set of "as-constructed" drawings which clearly indicate all deviations from the basic Contract Drawings, including exact dimensioned locations and depths for all stubbed conduits, location and size of spare conduits and conductors, all new and uncovered existing work outside the buildings, power feeder runs, and communications "primary" conduit runs per requirements of the General Conditions. Corrections and changes shall be kept up-to-date at all times.

All submittals and shop drawings shall be resubmitted with record drawings showing all revisions and changes made, clearly marked with field termination wire so as to reflect actual construction record conditions. Revision and changes will be enumerated and new dates of drawings shown. The Contractor shall file all submittals with the Engineer at the conclusion of work. Acceptance of the work may be delayed by the Engineer until all submittals are complete.

83-17 System Guarantee
In conformance with Section 7-23, "Guarantee," the entire lighting system shall be guaranteed by the Contractor to give satisfactory service operating without defect, and the Contractor shall guarantee the quality of materials, equipment and workmanship, including settling of backfilled trenches or other areas of work below finish grade, for a period of one year following the date of the filing of the Notice of Acceptance for all of the work by the City.

If, within one year from the date of the filing of the Notice of Acceptance for all of the work, any portion of the work, including all materials furnished and installed, which fails to function as originally designed and installed resulting from inferior or faulty materials or workmanship, or settlement occurs requiring adjustments in conduits, pull boxes, cabinets, services, switchboards, lights, or any other facilities or equipment furnished and installed, paving or other surface restoration, to the proper level of the permanent grades, the Contractor, as part of the work under his Contract, shall make all adjustments and corrections without extra cost to the City, including the complete restoration of all damaged planting, paving, or other improvements of any kind. Any damage to other work resulting from such failure or the correction thereof shall be remedied at the Contractor's expense.

83-18 Operations And Service Manual

At the completion of the work and prior to acceptance by the Engineer, the Contractor shall furnish an Operations and Service Manual to the Engineer. Information contained in the manual shall consist of 8-1/2 inch x 11 inch size catalog data on each item, together with parts lists, description of operation, maintenance information, shop drawings, wiring diagrams, and test reports as installed. Catalogs and data in the manuals shall be neat, clean copies. Drawings shall be accordion folded to letter size and installed in an envelope within the manual. An index shall be provided, which shall list all contents in an orderly manner with the respective equipment supplier's name, address and telephone number, and the manufacturer's recommended servicing instructions. Diagrams shall be complete for each system installed. Provide divider sheets with identifying tabs between each category.

83-19 Measurement And Payment

Lights.

Unless otherwise specified in the Contract Specifications, lights will be measured and paid for on an each basis, which shall include the furnishing and installing the light fixture complete with foundation, lenses, bulbs, internal wiring, and all other appurtenances thereto.

Electrical System.

Unless otherwise specified in the Contract Specifications, lighting electrical systems will be measured and paid for on a lump sum basis for the entire system, complete in every detail. The lump sum price paid for the electrical system shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as specified in the Specifications, and as directed by the Engineer. This shall include clearing and grubbing, furnishing and installing all equipment such as conduits, pull tape, tracer wire, pull boxes, cabinets, sensors, wiring, electric service, excavation, backfill and compaction, testing, adjusting, guaranteeing, and all incidentals.

SECTION 84 - TRAFFIC STRIPES, SIGNS, AND PAVEMENT MARKINGS

84-1 General

This work shall consist of furnishing and installing thermoplastic or painted traffic stripes (traffic lines), traffic signs, and pavement markings including glass beads, at the locations and in accordance with the details shown on the Plans, as specified in the Specifications, or as directed by the Engineer.

For the purposes of these Standard Specifications, traffic stripes (traffic lines) are defined as longitudinal centerlines and lanelines which separate traffic lanes in the same or opposing direction of travel, and longitudinal edgelines which mark the edge of the traveled way or the edge of lanes, or longitudinal lines which mark bicycle lanes. Pavement markings are defined as transverse markings which include, but are not limited to, word and symbol markings, limit lines (stoplines), crosswalk lines, bicycle lane markings, shoulder markings, and parking stall markings.

84-2 Materials

84-2.1 Thermoplastic materials

Thermoplastic material shall conform to Section 84-2.02 "Materials," of the State Standard Specifications, except that only Alkyd Binder Thermoplastic shall be used.

84-2.2 Paints

Paint shall be waterborne unless otherwise shown on the plans or specified in the Contract Specifications. All paints, whether waterborne or solventborne, shall be rapid dry, designed for traffic use and shall conform to the latest revisions of the San Joaquin Valley Unified Air Pollution District, Control Architectural Coatings Rule 4601 which requires that traffic paints shall not exceed the limit of 150 grams of volatile organic compounds (VOC's) per liter of coating as applied, excluding water. Paint shall also comply with any applicable State air pollution regulations.

84-2.2(A) Waterborne Paint

Waterborne paint (rapid dry) shall comply with the following specifications:

Color	White	Yellow	Black
Pigment, % by weight +/- 2%	60	59	58
Vehicle, % by weight	38-42	38-42	38-42
Total Solids, % by weight minimum	76	75	74
Viscosity, K.U. @ 77° F	78-92	78-92	78-92
Fineness of Grind, Hegman minimum	3.5	3.5	3.5
Dry time: 77° F without beads ASMT D-711, minutes maximum	10	10	10
Flexibility, 8 Mils wet, 24 hours are dry ½" Mandrel	No cracking	No cracking	No cracking
Contrast Ratio: 15 Mils wet, min.	.98	.98	.98
Weight per gallon minimum	13.50	13.0	12.50
Reflectance, minimum	85	50	N/A
VOC gms/liter, maximum	150	150	150

84-2.2(B) Solvent Borne Paint

Where shown on the Plans or specified by the Contract Specifications to be applied, solvent borne paint shall comply with the following specifications:

Color	White	Yellow	Black
Pigment, % by weight	57-62	57-62	57-62
Vehicle, % by weight	38-42	38-42	38-42
Total Solids, % by weight minimum	72	72	72
Viscosity, K.U. @ 77° F	70-85	70-85	70-85
Fineness of Grind, Hegman Minimum	4	4	4
Dry time: 77° F without beads ASMT D-711, minutes maximum	3-6	3-6	3-6
Flexibility, 8 Mils wet, 24 hours are dry ½" Mandrel	No cracking	No cracking	No cracking
Contrast Ratio: 15 Mils wet, min.	.98	.98	.98
Reflectance, minimum	85	50	N/A
VOC gms/liter, maximum	150	150	150

84-2.3 Glass Beads

Glass beads (spheres) shall conform to State Specification No. 8010-004 (Type II) and meet the following requirements.

General. Glass spheres shall lend themselves readily to firm embedment when dropped on freshly placed waterborne and solvent borne traffic paint.

Appearance. A minimum of 75% of the spheres by count shall be true spheres when testing in accordance with applicable ASTM Methods. They also shall be free of air inclusions, milkiness and dark spots. The spheres shall be clean and free of any foreign material.

Coatings. Spheres to be used on Waterborne Paint: The spheres shall be treated with the correct coatings to maximize proper embedment and adhesion in water borne paint.

Spheres to be used on Solvent Borne Paint: The spheres shall be completely uncoated. There shall be no moisture or adhesion coating applied to the spheres.

Gradation. The glass spheres shall conform to the following grading requirements to closely match the AASHTO Designation: M-247.

US Mesh	% By Weight Passing
20	100
30	85 +/- 10%
50	15-35
100	0-5

84-2.2(B) Solvent Borne Paint

Where shown on the Plans or specified by the Contract Specifications to be applied, solvent borne paint shall comply with the following specifications:

Color	White	Yellow	Black
Pigment, % by weight	57-62	57-62	57-62
Vehicle, % by weight	38-42	38-42	38-42
Total Solids, % by weight minimum	72	72	72
Viscosity, K.U. @ 77° F	70-85	70-85	70-85
Fineness of Grind, Hegman Minimum	4	4	4
Dry time: 77° F without beads ASMT D-711, minutes maximum	3-6	3-6	3-6
Flexibility, 8 Mils wet, 24 hours are dry ½" Mandrel	No cracking	No cracking	No cracking
Contrast Ratio: 15 Mils wet, min.	.98	.98	.98
Reflectance, minimum	85	50	N/A
VOC gms/liter, maximum	150	150	150

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Spheres to be used on Solvent Borne Paint: The spheres shall be completely uncoated. There shall be no moisture or adhesion coating applied to the spheres.

Gradation. The glass spheres shall conform to the following grading requirements to closely match the AASHTO Designation: M-247.

US Mesh	% By Weight Passing
20	100
30	85 +/- 10%
50	15-35
100	0-5

Physical Properties. Glass spheres shall conform to the following properties:

Refractive Index, minimum 1.50

Moisture Content, maximum 0.01%

84-2.4 Traffic Signs
All traffic signs shall conform to the current Standards of the California MUTCD and the following:

All traffic signs shall be 0.080 inch thick aluminum.
Stop Signs, Speed Limit Signs, and all School and Pedestrian Signs shall have a 3M #4090 DG3 reflective sheeting with an applied 3M #1160 or equal Graffiti Film.
School and Pedestrian Signs shall be Florescent Yellow Green in color.
All other signs shall have 3M #3930 High Intensity Prismatic reflective sheeting with an applied 3M #1160 or equivalent Graffiti Film.

84-2.5 Sign Mounting Hardware
All mounting hardware shall be zinc coated, galvanized, or stainless steel. ~~Aluminum will only be allowed for rivets.~~ Banding shall be ½ inch wide stainless steel. Hose clamps are not permitted. All Signs shall be mounted using bolts. Rivets are not permitted.

84-2.6 Sign Posts
All posts for traffic signs shall be 2 inch square x 12 gauge galvanized steel, with holes punched on all four sides for the entire length of the post.

84-3 Removal Of Existing Markings
Removal of existing striping or pavement markings shall comply with Section 15-2.02(C), "Traffic Stripes and Pavement Markings," and the directions of the Engineer.

84-4 Application Equipment
Application equipment for paint shall comply with Section 84-3.04, "Application Equipment," of the State Standard Specifications ~~and all equipment shall be "No Airspray Equipment".~~, except for the use of "AIRSPRAY" equipment. Only "AIRLESS" type equipment will be allowed to be used to apply traffic paint for striping or stenciling. The use of "AIRSPRAY" type of equipment is not allowed in the City of Clovis.

84-5 Application Of Thermoplastic Material, Paint, And Beads
Preparation of surfaces and application of thermoplastic material and beads shall comply with the requirements of Section 84-2.04, "Application," of the State Standard Specifications, except as amended by these Standard Specifications. Pedestrian Crosswalks shall be installed using extruded type Alkyd Binder Thermoplastic material applied at a thickness of 125 mils (+/- 15 mils).

Beads for thermoplastic material shall be 25-30% of the material before application, and applied to the extruded material immediately after application.

Preparation of surfaces and application of paint and beads shall conform to the requirements of Section 84-3.05, "Application," of the State Standard Specifications, and as amended by these Standard Specifications. Tolerances and appearance shall conform to the requirements of Section 84-1.03, "Tolerances and Appearance," of the State Standard Specifications.

The application rates of waterborne or solvent borne paint provided in Section 84-3.05, "Application," of the State Standard Specifications and as amended by these Standard Specifications. Two coats of paint shall be applied at the rate of 100 square feet per gallon of paint at a thickness of 15 mils wet. Beads shall be applied for both coats of paint at a rate of 5 lbs. per gallon of paint.
Word markings, letters, numerals, legends and symbols shall be applied utilizing suitable approved equipment together with approved stencils and templates. All markings shall be standard, and shall be identical with those used by the City of Clovis. The Contractor shall borrow stencils for directional arrows and word markings from the City of Clovis Public Utilities Department at 155 N. Sunnyside Avenue and return them in good condition. Stencils damaged by the Contractor will be replaced at the Contractor's expense.

When no previously applied figures, markings, or traffic striping are available to serve as a guide, suitable layouts such as "cat-tracking" shall be spotted in advance of the permanent application. Written approval of temporary layout shall be obtained prior to permanent application. The Contractor shall mark or otherwise delineate the traffic lanes in the new roadway or portion of roadway, or detour, before opening it to traffic.

Where necessary, the Engineer will furnish the necessary control points for all required pavement striping and markings. Alignment and layout of the work by the Contractor shall conform to Section 84-1.02, "Control Of Alignment and Layout," of the State Standard Specifications. The Contractor shall provide an experienced technician to supervise the location, alignment, layout, dimensions, and application of the pavement striping and marking.

In areas of high traffic volume, the Contractor shall schedule work to apply traffic lines and markings in off-peak traffic hours, or on weekends. In all cases, the Contractor shall use proper and sufficient directional signs, warning devices, barricades, pedestals, lights, traffic cones, flagpersons, or such other devices to protect the work, workers, and the public.

All markings and striping shall be protected from injury and damage of any kind while the material is drying. All adjacent surfaces shall be protected from disfiguration by spatter, splashes, spillage, and dripping of material. Damaged stripes or markings shall be cleaned and reapplied by the Contractor at his expense.

84-6 Traffic Sign Installation

Traffic signs shall be installed at the locations, of the type, and at the height shown on the Plans, as specified in the Specifications, as directed by the Engineer, and in conformance with the current California MUTCD.

If a sign is to be installed in existing concrete, the concrete shall be cored with a 6-inch diameter hole.

If a sign is to be placed where new concrete is to be poured, a 6-inch diameter PVC sleeve shall be provided in the new concrete. Solid embedment of sign posts in concrete is not permitted. Sleeves may be obtained from the City of Clovis Public Utilities Department at 155 N. Sunnyside Avenue.

Sign posts shall be imbedded in the ground to the depth specified in the Plans, Contract Specifications, or California MUTCD as applicable. Any voids around sign posts passed through sleeves in concrete shall be backfilled with soil and thoroughly compacted to the satisfaction of the Engineer.

84-7 Measurement

Unless otherwise specified in the Contract Specifications, striping and marking pavement shall be measured on a lump sum basis, and shall include any required removal of existing pavement striping or markings.

Unless otherwise specified in the Contract Specifications, traffic signs will be measured on a per each basis.

84-8 Payment

The lump sum price paid for striping and marking pavement shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved therein as shown on the Plans, as specified in the Specifications, or as directed by the Engineer.

The per each price paid for signs shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved in stalling signs as shown on the Plans, as specified in the Specifications, or as directed by the Engineer.

SECTION 86 - TRAFFIC SIGNALS AND INTERSECTION SAFETY LIGHTING

86-1 General
These Standard Specifications shall apply to the installation and modification of traffic signal and intersection safety lighting facilities and other traffic signal related work. Work or equipment not specified or shown on the Plans, these Standard Specifications and the Contract Specifications, but necessary for the proper operation of the work shall be provided and installed at no additional cost to the City.

86-2 Description
Furnishing, installing, modifying and removing traffic signals, and lighting systems shall conform to the provisions in Section 86-1.01, "Description," of the most recent issue of the Standard Specifications and Standard Plans of the Department of Transportation, State of California, the California Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, these Standard Specifications, the Standard Drawings, the Project Plans, and Contract Specifications. Payment therefor shall be as specified in the contract documents.

86-3 Definitions
Reference is made to 86-1.015, "Definitions," of the State Standard Specifications for definitions applicable to these Standard Specifications.

86-4 Regulations, Codes, And Permits
All electrical equipment shall conform to the provisions in Section 86-1.02, "Regulations and Code," of the State Standard Specifications. In conformance with Section 7-10, "Permits and Licenses," of these Standard Specifications, in addition to the required Encroachment Permit, the Contractor shall obtain an Electrical Permit for meter service pedestal installation or modification from the City Building Division and pay all associated fees therefor.

86-5 Equipment List And Drawings
Equipment lists and drawings of electrical equipment and material shall conform to the provisions in Section 86-1.04, "Equipment List and Drawings," of the State Standard Specifications and these Standard Specifications. The Contractor shall furnish circuit drawings for all electrical equipment supplied in the contract. The controller and controller cabinet drawings shall be approximately 24" x 36" in size and legible.

Equipment list shall give firm delivery dates for materials. In the event these dates cannot be met, the equipment supplier and Contractor shall provide documentary proof of search for alternate sources of supply at least 30 days prior to said promised delivery dates. Such actions shall not be justification for granting additional working days but shall be evidence of proceeding to completion in good faith.

The Contractor shall furnish a maintenance manual for all controller units and auxiliary equipment. The maintenance manual and operation manual may be combined into one manual. The maintenance manual or combined maintenance and operation 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:

1. Specifications
2. Design Characteristics
3. General Operation Theory
4. Function of All Controls

5. Trouble Shooting Procedure (Diagnostic Routine)
6. Block Circuit Diagram
7. Geographical Layout of Components
8. Schematic Diagrams
9. List of Replaceable Component Parts with Stock Numbers

86-6 Order Of Work

Order of work shall conform to the provisions in Section 5-1.05, "Order of Work" of the State Standard Specifications and these Standard Specifications.

First Stage Construction - This stage of construction shall consist of doing all underground signal and lighting work. The underground work consists of the installation of all conduit, including service conduit, pull boxes, signal, and luminaire bases, including P.P.B. bases, controller base, service cabinet and base, loop detectors, magnetic vehicle detectors and conductors. The Contractor shall comply with the following requirements:

1. The Contractor shall diligently prosecute the underground work to completion.
2. During the underground work all trenches, jacking pits, and foundation bases shall be maintained in a safe manner and as directed by the Engineer.
3. There shall be no prolonged inconveniences to property owners or vehicular traffic.
4. After completion of the underground work, the Contractor shall securely fasten all barricades to foundation anchor bolts. All debris shall be removed and the project site left in a neat and presentable appearance as directed by the Engineer.
5. All underground work within the roadway shall be completed prior to any road paving.
6. Refer to the Project Plans for additional Construction Notes.

Second Stage Construction - This stage of construction shall consist of doing the above-ground work. The above-ground work shall consist of the installation of the signal and luminaire standards, vehicle signal and pedestrian signal heads, P.P.B.'s, luminaires, detector probes, and controller cabinet(s). The Contractor shall comply with the following requirements:

1. The Contractor shall not do any above-ground work until all above-ground materials are received by the Contractor, except for luminaires, luminaire standards, conductors, and service cabinet may be installed prior to receiving all above ground materials.
2. The Contractor will be charged working days while waiting for shipment of the above-ground materials.
3. Refer to the Project Plans for additional Construction Notes.

86-7 Warranties, Guarantees, And Instruction Sheets

Workmanship and equipment guarantees shall conform to the provisions in Section 86-1.05, "Warranties, Guarantees, and Instruction Sheets," of the State Standard Specifications and to Sections 5-23, Guarantee of Workmanship," and 6-10, Guarantee of Materials," of these Standard Specifications. All materials replacing materials under warranty shall have the same warranty as stated in this contract. The new warranty shall commence at the date the original material is replaced with the new material.

All work done under the Contract by the Contractor shall be guaranteed in writing to the Engineer for 12 months from the date of acceptance. The terms of the guarantee shall be clearly stated and shall be approved by the Engineer prior to acceptance of the contract.

Prior to acceptance of the contract, the Contractor shall supply the City with the manufacturer's standard warranties and guarantees for the satisfactory operation of all materials supplied by the Contractor. This warranty or guarantee shall extend for a period of twelve months or more from the date of acceptance. Pedestrian signals shall be guaranteed by the manufacturer for two (2) years. Signal controller conflict monitors shall be guaranteed for two (2) years.

86-8 Maintaining Existing And Temporary Electrical Systems

Maintaining existing and temporary electrical systems shall conform to the provisions of Section 86-1.06, "Maintaining Existing and Temporary Electrical Systems," of the State Standard Specifications.

The Contractor may use temporary splices and wiring as approved by the Engineer to maintain existing and temporary traffic signal and lighting systems. Contractor shall install overhead conductors or cables, or use existing underground conductors with temporary splices together with a minimum of two (2) 12 inch one-way three section or four section signal faces, as required, for each direction of entering traffic to maintain traffic signal operation.

Shutdowns of traffic signal systems shall be limited to the period from 9 a.m. to 4 p.m. of normal working days, or as specified on the Plans or the Contract Specifications, excluding legal holidays, weekends, and non-working days as determined by Engineer. The limited time period for traffic signal shutdown between 9 a.m. and 4 p.m. shall be determined by the Engineer. Traffic control plans and plans indicating the use of temporary stop signs shall be submitted by the Contractor to the Engineer for approval five days prior to doing the work. Plans shall conform to the State of California Department of Transportation (Caltrans) Manual of Traffic Controls for Construction and Maintenance Work Zones, latest edition. No traffic signal shutdown shall be permitted without all traffic control devices in place and operational.

86-9 Scheduling Of Work

Scheduling of work shall conform to the provisions in Section 86-1.07, "Scheduling of Work," of the State Standard Specifications and these Standard Specifications.

The Contractor shall notify the Engineer at least one (1) working day in advance of any electrical work and also at least one (1) working day in advance of any work if any work is done intermittently in order that inspection can be coordinated.

86-10 Safety Precautions

All electrical work shall conform to the provisions in Section 86-1.08, "Safety Precautions," of the State Standard Specifications.

86-11 Excavating And Backfilling

All excavating and backfilling shall conform to the provisions in Section 86-2.01, "Excavating and Backfilling," of the State Standard Specifications, and Sections 8-15, "Utility and Non-Street Facilities; Potholing," and 19-3, "Trench and Structure Excavation, Backfill, Compaction, and Surface Restoration," of these Standard Specifications.

Backfilling shall be placed at a maximum slope of 2:1 (the 2 dimension shall be horizontal) from all bases, pull boxes and other facilities as directed by the Engineer. Water shall be capable of draining away from all signal facilities when slope work is completed. Backfill for all conduit crossing under pavement shall contain a two (2) sack slurry backfill to within 76mm (3 inches) of any finished surface.

When installing bases, conduit and pull boxes in areas with existing asphalt concrete or concrete, the existing asphalt concrete or concrete shall be sawcut and removed to the width necessary for trenching or digging. All asphalt concrete, concrete and dirt removed shall become the property of the Contractor. After installation of conduit, bases and pull boxes and the backfilling and compacting of dirt, concrete or asphalt concrete shall be supplied and installed of equal material and thickness of the asphalt concrete or concrete removed. Within the road bed, conduits shall be placed by jacking or directional boring methods as stated in Section 86-2.05C, "Installation," of the State Standard Specifications. Conduit shall also be placed by jacking or directional boring methods beneath sidewalks and driveways as directed by the Engineer.

When removing the asphalt concrete or concrete from the median for the installation of conduit and pull boxes for the left turn, intermediate and far detectors, a sawcut shall be made adjacent to the curb farthest from the left turn lane (adjacent to through traffic lane) to the width needed for conduit and pull box installation. Asphalt concrete or concrete and dirt shall be removed between this sawcut and the existing curb.

86-12 Removing And Replacing Improvements

Removing and replacing improvements shall conform to the provisions in Section 86-2.02, "Removing and Replacing Improvements," of the State Standard Specifications and these Standard Specifications.

It shall be the Contractor's responsibility and expense to remove and replace all improvements, including improvements damaged by the Contractor, as stated under Section 86-22, "Testing," in these Standard Specifications.

86-13 Foundations

Foundations shall conform to the provisions in Section 86-2.03, "Foundations," of the State Standard Specifications and these Standard Specifications.

Portland Cement Concrete shall conform to Section 90, "Portland Cement Concrete," of the State Standard Specifications, may be produced from commercial quality aggregates, and shall be Class 2 containing not less than 590 lbs/yd^3 (6-sack mix) of Portland Cement. No admixtures shall be used without written permission from the City. All concrete shall have a Class I surface finish as specified in Section 51-1.18B, "Class 1 Surface Finish," of the State Standard Specifications, unless these Standard Specifications or Contract Specifications specify otherwise.

The controller cabinet base shall be 8 inches higher than the surface of controller cabinet pad or sidewalk. Controller pad shall be 0.1 foot above finished grade if placed in unpaved area, unless elevation is stated on plans. If the pad is located in an existing or future sidewalk area, pad shall be placed at sidewalk elevation. The controller cabinet foundation shall be constructed to place the police panel on the cabinet facing the adjacent street.

Foundation caps for signal standard bases not in existing sidewalk area shall be as follows: P.P.B. posts shall be 18 inch square or round, type I-A shall be 24 inch square or round, all other foundation caps for signal standard bases shall be 30 inch square or round. If a square foundation cap is used, the sides of the cap shall be parallel or at right angles to road center line. Foundation caps shall be 3.5 inches in thickness. If sidewalk is being constructed at the same time as the signal standard bases are being constructed, the signal standard base cap shall be placed monolithically with the sidewalk and at the same thickness as the sidewalk. Top of all foundation caps for signal posts and standards shall be at sidewalk elevation or as stated on plans or as directed by the City Engineer.

After installation of signal standards, anchor bolt threads shall extend three threads beyond the top of the nut. If bolt threads extend beyond this specification, bolts shall be cut to three threads above nut and painted with 2 applications of approved (organic vehicle type) unthinned zinc rich primer, conforming to the requirements in Section 91, "Paint," of the State Standard Specifications. Aerosol cans shall not be used.

The exact location of all foundations for signal equipment, controller and service enclosures shall be approved by the Engineer prior to the start of any excavation work.

86-14 Standards, Steel Pedestals, And Posts

Standards, steel pedestals and posts shall conform to the provisions in Section 86-2.04, "Standards, Steel Pedestals and Posts," of the State Standard Specifications and these Standard Specifications. All standards shall be round.

When the Contractor or distributor places order for signal standards and mast arms, the plans and specifications shall be sent with the order to the manufacturer, enabling the manufacturer to construct the standards and mast arms as shown on the Plans or specified in the Specifications.

Standards shall not be painted except for luminaire identification number. Numbers shall be placed on all new standards on which luminaires are installed. The Engineer shall obtain these numbers from Pacific Gas and Electric Company and place on plans in a schedule. These numbers shall be 3 inches in height and shall be placed after standard and signal head and/or luminaire installation. The stencil used for painting these numbers shall be approved by the City prior to painting. The galvanized surface of the standard shall be cleaned prior to painting these numbers as stated in Section 86-2.16, "Painting," of the State Standard Specifications. The numbers shall be painted on the signal standards using two applications of black enamel. Reflectorized adhesive numbers conforming to PG&E standards and specifications may be used in lieu of painting numbers on standards. Numbers shall be located facing the center of the intersection and 10 feet above the base plate of the standard. Reflectorized adhesive numbers shall have black numbers and reflective silver or white backgrounds.

When the mast arm is not installed, the Contractor shall place a galvanized steel rain cover (provided by the pole manufacturer) to seal the hole, chased for electrical conductors, entering the standard. The rain cover shall be bolted to the pole using the standard mast arm bolts supplied with the pole.

The grounding nut welded inside the standard near the handhold shall have clean usable threads. The grounding bolt shall also have clean usable threads and can be threaded into grounding nut without using rethreading tools.

The Contractor shall be certain prior to installing any new or salvaged signal equipment that this signal will be visible to the motorists and pedestrians, and the equipment will not block or obscure any existing signal equipment from the motorist or pedestrian's view.

Full compensation for furnishing and installing signs and mounting hardware on traffic signal standards and mast arms shall be considered as included in the contract lump sum price paid for traffic signals and lighting, and no additional compensation shall be allowed therefor.

86-15 Conduit

Conduit shall conform to the provisions in Section 86-2.05, "Conduit," of the State Standard Specifications and these Standard Specifications. Conduit material shall be Type 1 as stated in Section 86-2.05A, "Material," Item (A) of the State Standard Specifications. Conduit shall be rigid metallic conforming to the requirements in UL Publication UL 6. Non-metallic, flexible and intermediate metallic conduit shall not be used, except as shown on the Plans or as stated in the Contract Specifications or these specifications.

Conduit terminating in standards or pedestals shall extend not more than 2 inches vertically above foundation and shall be vertical. Conduit terminating in pull boxes shall extend 2 inches into the cavity of the pull box. Conduits shall enter the pull box at the top of the extension. No conduit may enter a pull box from the bottom, unless approved by the Engineer. After conductors have been installed, the ends of the conduits terminating in pull boxes, controller cabinet and service pedestal shall be sealed with an approved type of sealing compound.

Plastic bushings shall also be required on the ends of non-metallic conduit. This includes, but is not limited to, both ends of the 3 inch PVC conduit used for magnetic vehicle detectors and both ends of any 3/4" PVC loop detector conduit or home run conduits.

When "Trenching in Pavement Method" is specifically allowed, the installation shall conform to the provisions in Section 86-2.05C, "Installation," of the State Standard Specifications and these Standard Specifications. When conduit is installed using the "Trench in Pavement Method", Type 1 conduit shall be used except when the conduit is to be used for magnetic detectors. (See Section 86-41, "Magnetic Detector Installation Procedure" of these Standard Specifications for magnetic detector conduit installation.) Conduit shall be installed 30" below finished grade in all areas except in sidewalk and in median areas where the depth shall be not less than 18 inches below grade. Patch mix asphalt concrete shall be Type B (½ inch maximum, coarse); shall conform to the provisions in Section 39-2, "Materials" and Section 39-3, "Storing, Proportioning, and Mixing Materials" of the State Standard Specifications and the Contract Specifications, and shall include treatment by heater remix, as shown on City of Clovis Standard Drawing ST-20.

Insulated bonding bushings shall be required. These bushings shall be a Thomas & Betts "Blackjack" Series BG100 – BG600 malleable iron bushings, or approved equal, and shall contain the following features:

1. Approved for threaded and non-threaded Type 1 conduit installation.
2. A lay-in style grounding lug cast integral to the bushing. Wire range shall be 14-2/0.
3. Bushing insulator rated to 150°C covering the top of the bushing, including lug corners. Insulator shall be positively locked into place.
4. Hex head stainless steel mounting screw with nylon locking patch and a cone tip point to lock the bushing securely in place.
5. Cast "threads" opposite the mounting screw to tighten the fit during installation.
6. The bushing shall of malleable iron construction and shall be zinc plated or mechanically galvanized.

All metallic conduits within a pull box, cabinet, or pedestal shall be bonded together by means of a solid No. 8 bare copper wire connected to the individual bonding bushings.

The distance between conduits entering pull boxes and cabinet bases shall be a minimum of two inches. No conduit run shall pass through a signal, controller or luminaire base (including future bases as shown on plans) except the conduit which terminates within the base.

If conduit is installed under existing pavement, sidewalk, or driveway, it shall be placed by directional boring or jacking. Pavement shall not be disturbed without the written permission of the Engineer.

If more than one conduit is being jacked to the same location, and are parallel to each other, or if one conduit is being jacked parallel to an existing conduit, a distance of 18 inches or more shall be maintained between these conduits. All dirt and debris shall be cleaned out of conduits prior to installing conductors.

Where conduit is installed and no conductors are placed within said conduit, the contractor shall, in the presence of the Engineer or his representative, pull a mandrel or cylindrical wire brush of appropriate and approved size through the conduit, and then the conduit shall be blown out with compressed air. When required by the engineer, the ends of conduits containing no conductors shall be threaded and shall be capped using standard pipe caps or "pennies" to protect the raceway against dirt and concrete until wiring is installed.

86-16 Pull Boxes

Pull boxes shall be of the type or model shown on the Plans and conforming to the provisions in Section 86-2.06, "Pull Boxes," of the State Standard Specifications and these Standard Specifications. Pull boxes, covers and extensions shall be precast reinforced concrete, except as shown on plans or in the standard drawings. All pull box lids shall be lockable.

All pull boxes shall have extensions. All pull boxes shall be No. 5E unless otherwise noted on the Plans. Lids for No. 6 pull boxes shall be plastic. Metal lids on traffic rated pull boxes need not be reinforced. Pull boxes housing Signal Interconnect Cable (SIC) or fiber optic communications facilities at signalized intersections shall be a Christy N48T utility box w/ two (2) extensions and a 2-piece reinforced concrete lid, or approved equal. Intermediate pull boxes not located at intersections shall be No. 6E or greater.

When pull box extensions are used, grouting shall be placed between pull box and extension. A layer of roofing paper shall be wrapped around pull box and extension prior to backfilling dirt. Dirt and debris shall be removed from pull box prior to installing conductors. A one inch (1") diameter drain hole shall be provided in the center of the pull box. Grout shall be installed to cover the crushed rock sump bottom of the of the pull box and sloped toward the drain hole. The drain hole shall run through the grout bottom into, and exposing, the rock sump. Contractor's attention is directed to Section 86-2.06C, "Installation and Use," of the State Standard Specifications; conductors shall not be installed prior to grouting the pull box.

Pull boxes shall be placed at same elevation as adjacent standard base, service cabinet base or signal controller cabinet base if not in an existing or future sidewalk area, and elevation is not shown on plans. Pull boxes shall be 5 feet from base or as shown on the plans. Pull boxes in existing or future sidewalk areas shall be placed at sidewalk elevation. The pull box elevation for pull boxes installed in median areas shall match the slope of the two adjacent curbs.

The pull box elevation for pull boxes installed in sidewalks, planting areas adjacent to sidewalks or median islands shall be at proposed final grade. Pull box elevation shall be 0.1 foot above finished grade for all other areas unless elevation is shown on plans or otherwise directed by the

Engineer. Pull boxes installed in median islands for left turn, intermediate, and far detectors shall be placed adjacent to the curb farthest from the left-turn lane.

When pull boxes are placed in dirt and planting areas, a concrete collar shall be constructed around the pull box. The surface elevation of the collar shall match the surface elevation of the pull box and slope away from the pull box at a rate of 1:50 (2% slope). The width of the collar shall be 12 inches wide and 3½ inches in depth. Concrete collars installed near the back of curb shall abut the back of the curb.

The longest dimension of the pull box shall be parallel to the road centerline or as shown on plans, or as directed by the Engineer. Pull boxes for the installation of magnetic vehicle detectors (probes) shall be installed with the largest dimension of the pull box at right angles to the road centerline and parallel to magnetic detector conduit run.

On long runs, pull boxes shall be installed at a maximum spacing of 200 feet. Pull boxes shall be required at all conduit change of direction or changes in conduit material or size.

The words SIGNAL, TRAFFIC SIGNAL, STREET LIGHTING, INTERCONNECT, or COMMUNICATIONS as appropriate, shall be inscribed on all pull box covers except for the splice box (if used) adjacent to PG&E's service pole. This pull box cover shall be inscribed as indicating "P. G. & E." Pull box covers shall not contain hold-down bolts or holes unless otherwise shown on the Plans or specified in the Contract Specifications.

At completion of all work in pull boxes, an approved ant repellent (Rainbow Insect Control Distributed by Southwest Power, (800) 670-7746 or approved equal) shall be supplied by the Contractor and installed by the City.

86-17 Conductors And Wiring

Conductors and wiring shall conform to the provisions in Section 86-2.08, "Conductors," Section 86-5.01A(4), "Construction Materials," and Section 86-2.09, "Wiring," of the State Standard Specifications and these Standard Specifications.

1. Multi-conductor cable used for vehicle signals, pedestrian signals and P.P.B.s from controller cabinet to terminal blocks on standards shall be polyethylene insulated, polyethylene jacketed, of 600 volt rating, IMSA color coded, and shall comply with International Municipal Signal Association specifications No. 20-1-1962, or the IMSA superseding specification of more recent issue. The 3, 5, and 7 Conductor cables shall be 14 AWG solid copper.
2. Conductor cables to be used are as follows:
   (a) 7 conductor cable shall be used for all vehicle signals only.
   (b) 5 conductor cable shall be used for all pedestrian signals only.
   (c) and 2 conductor cable shall be used for all P.P.B.'s.
   (d) Type "C" DLC cable shall be used for all detector lead-in circuits.
   (e) Cables shall not be spliced to any other cable.
   (f) 3 single conductors shall be used for photoelectric switches.
   (g) Approved 3 conductor cable shall be used for emergency preemption detectors. (See 'Modulated Light Signal Detection System').

(h) Belden No. 8281 cable shall be used for video camera detection systems.

(i) Type “C” DLC cable (No. 14 AWG) shall be used to supply power to the pole mounted cameras used in video detection systems.

3. Detector lead-in cable shall be Type "C" and have a polyethylene jacket (IMSA specification number 50-2, 1984).

4. The 7 conductor cables shall not be connected to the pedestrian signal mounting terminal block.

5. The 5 conductor cables shall not be connected to the vehicle signal mounting terminal block.

6. The 3 & 2 conductor P.P.B. cables shall be connected in the pedestrian signal mounting terminal block. The P.P.B. neutral shall never be connected to the pedestrian signal 120 volt neutral.

7. Conductor installation and cable insulation colors in cables shall be as shown on terminal location drawing in the Technical Specifications. All neutral conductors shall be white throughout their entire length.

8. All conductors shall have insulation colors appropriate to the use of the conductor and all applicable codes. The use of colored phase tape will not be allowed.

The first sentence of the second paragraph of Section 86-2.09A, “Circuitry,” of the State Standard Specifications is amended to read:

All control circuit conductors shall be run continuously without splices from a terminal block located in the traffic signal controller cabinet to the terminal compartments on the signal standard mountings and to the P.P.B.'s. Detectors circuits shall run from the controller cabinet to the pull box adjacent to detectors with no splices.

In Section 86-2.09D, “Splicing and Terminations,” of the State Standard Specifications, delete Item No. “E”, which states: "UNGROUNDED TRAFFIC SIGNAL INDICATION CONDUCTORS TO A TERMINAL COMPARTMENT OR SIGNAL HEAD ON A STANDARD MAY BE SPLICED TO THROUGH CONDUCTORS OF THE SAME PHASE IN THE PULL BOX ADJACENT TO THE STANDARD."

All conductors running to a terminal block shall be connected to the terminal block. Conductors between the signal mounting terminal block on the standard and the terminal strip in the signal head or pedestrian head shall be No. 16 AWG or larger stranded THWN, except for M.A.S. and M.A.T. signal conductors which shall be No. 14 AWG stranded THWN.

Conductor insulation color within mounting assemblies shall be red, yellow and brown for vehicle signals and brown for "walk" and red for "don't walk" for pedestrian signals. All neutral conductors shall be white throughout their entire length. All single conductors, except bonding jumpers, shall be stranded. All splices shall be made at the midpoint of the slack conductor in all pull boxes and standards. All conductors shall be copper. Insulation on all single conductors in underground conduits shall be THWN except for bonding conductor.

At any point, the minimum thickness of any Type THWN insulation shall be 13 mils for conductor sizes No. 14 and No. 12, 18 mils for conductor size No. 8 and No. 6, and 36 mils for conductor sizes No. 4 and No. 2. At any point, the minimum thickness of the nylon jacket shall be 4 mils for conductor sizes No. 14 to No. 10, inclusive, 5 mils for conductor sizes No. 8 and

No. 6, and 6 mils for conductor sizes No. 4 and No. 2. Lighting conductors between each luminaire and the adjacent pull box shall be No. 10 AWG with THWN insulation.

Traffic signal and beacon conductors shall not be spliced. Connections shall be made at terminals within the terminal compartment on signal mountings, terminals on P.P.B.s and terminals in the controller cabinet or service cabinet only. All conductors fastened to connections on P.P.B. shall have crimp-style terminal lugs. All conductors shall be fastened to terminals in the controller cabinet using crimp style terminal lugs. All lugs shall be soldered to conductors. This includes all new installations and all modified installations.

The cables that comprise a signal phase shall have an identification band placed near the end of the termination points and in every pull box. The identification band shall be a 3/8" plastic strip and installed with a non-ferrous permanent fastener. All cables shall be labeled per phasing shown on plans. The cables that are connected in the controller cabinet shall have an identification band that identifies the pole location where the cable terminates.

Detector splices shall be as stated in Section 86-2.09E, "Splice Insulation," of the State Standard Specifications. Detector splices shall be made only in the pull box adjacent to the detector. All splices insulated by Method "B" as shown in the State Standard Plans page ES-13A shall be covered by an outer layer of friction tape. Cover entire splice with electrical insulating coating and allow to dry. Heat-Shrink Tubing may be used and shall conform to the specifications stated in Section 86-2.09E, "Splice Insulation," of the State Standard Specifications. Splices shall be in-line splices and shall be soldered with rosin core solder. No open flame soldering shall be allowed. At pull boxes, all conductors containing splices shall be neatly placed on top of all other conductors within the pull box.

Signal Interconnect Cable (SIC) shall be as stated in Section 86-2.08E, "Signal Interconnect Cable (SIC)" of the State Standard Specifications and shall consist of six No. 20, minimum, stranded tinned copper conductors as shown on the plans. Each conductor shall be insulated with 0.013 inch, minimum nominal thickness, color coded, polypropylene material. Conductors shall be in twisted pairs. Color coding shall distinguish each pair. Each pair shall be wrapped with an aluminum polyester shield and shall have a No. 22 or larger, stranded, tinned copper drain wire outside the shielded pair. Splices shall not be made. Cable shall run from one traffic signal controller cabinet to the next traffic signal controller cabinet with no splices.

The cable jacket shall be black, high density polyethylene, rated for a minimum of 300 volts and 140° F, and shall have a nominal wall thickness of 40 mils, minimum. The cable jacket or the moisture-resistant tape directly under the outer jacket shall be marked with the manufacturer's name, insulation type designation, number of conductors and conductor size, and voltage and temperature ratings.

The Optical Detector Cable shall be designed to be utilized by the Opticom™ Priority System (700 Series or better) furnished by the 3M Company [Advanced Traffic Products, Inc., 909 SE Everett Mall Way, Suite B280, Everett, WA, 98208-3740, Phone (425) 347-6208, Fax (425) 347-6308, or contact a local authorized 3M dealer]. One optical detector cable shall be installed to the mast arm standard (as shown on the plans). The length(s) of each cable shall be sufficient to run from the controller through the conduit system to the end of the mast arm plus an additional 15 feet. The cable will be run through the conduit system toward its respective mast arm standard. No splices will be allowed in the cable. The excess cable shall be neatly bundled, tied, and placed in the standard's adjacent pull box.

86-18 Fused Splice Connectors
All fused splice connectors shall conform to the provisions in Section 86-2.095, "Fused Splice Connectors," of the State Standard Specifications. Fuse rating and type shall be as shown on page ES-13B of the State Standard Plans.

Fuses shall be the standard midget ferrule type, with "non-time-delay" feature, and shall be 13/32 inches x 1-1/2 inches. The fuse shall be supplied and installed in pull box adjacent to luminaire. Fuse shall be installed on the ungrounded conductor.

Fuse holder shall be installed so the fuse is retained in the load side of the holder when disconnected. The head of the metal assembly screw shall be recessed a minimum of 1/32 inch below the top of a plastic boss which surrounds the head.

86-19 Bonding And Grounding
Bonding and grounding shall conform to the provisions in Section 86-2.10, "Bonding and Grounding," of the State Standard Specifications and these Standard Specifications. Bonding and grounding of electrical systems shall be by stranded or solid copper wire. A 5/8 inch x 8 foot copper clad ground rod shall be installed within the service cabinet enclosure and shall be connected to the grounding point in the service pedestal using a No. 6 AWG copper wire. Equipment bonding jumpers shall be No. 8 AWG or larger copper wire.

A No. 8 AWG stranded copper grounding conductor with green THWN insulation shall be installed in all signal and street lighting conduits and connected to the bonding wire between bonding bushings by means of split bolt or approved C-tap connectors. This grounding conductor shall be extended and attached to the grounding point within the service pedestal, the controller cabinet, and to each signal and lighting standard.

If a stranded No. 8 AWG bonding jumper is used to bond the signal and lighting standards, it shall be connected to the standard using a ring terminal crimp connector of the correct size.

To bond PPB posts, a solid No. 8 AWG bonding jumper shall be connected between the leveling nuts on all anchor bolts and the PPB post, and run to the bonding wire in the adjacent pull box.

Grounding jumpers shall be visible after cap has been poured on foundation. Grounding jumpers shall be attached by a 3/16 inch or larger brass bolt in the signal standard or controller cabinet and shall be run to the ground rod or bonding wire in adjacent pull box.

86-20 Service
Service shall conform to the provisions in Section 86-2.11, "Service," of the State Standard Specifications and these Standard Specifications.

The service shall be 120 volts for signal circuit and 120 volts for safety and street lighting circuit. See the Plans and Contract Specifications.

86-21 Service Equipment Enclosure
A service equipment enclosure shall be installed as shown on the Plans and stated in these Standard Specifications. Enclosure shall meet the requirements of the servicing utility, and shall conform to the provisions in Section 86-1.02, "Regulations and Code" of State Standard Specifications, and to Section 86-4, "Regulations, Codes, and Permits," of these Standard Specifications. Enclosure shall be factory pre-wired and tested to meet NEMA standards. The

Contractor shall secure an electrical service permit from the City of Clovis Building Department prior to installing the service cabinet.

Service cabinet shall be Tesco 26-100 Type III AF, Tesco 24-200 UPS, or approved equal. See City of Clovis Standard Drawing TS-5. The service cabinet shall have an external receptacle for an auxiliary power source. Metal work shall be cold rolled sheet steel throughout; 12 gauge hot dipped galvanized steel exterior and 14 gage interior. Seams shall be welded using the most advanced TIG or MIG method. External corners and seams to be ground smooth, doors to be padlock able and vandal resistant. A padlock shall be furnished by the City of Clovis for the service cabinet.

Hinges shall be continuous stainless steel piano type. No screws, rivets, or bolts shall be visible outside the enclosure. Enclosure shall be constructed to conform to provisions of a Type III AF service, in accordance with the latest edition of the State Standard Plans. Measurement of enclosure to conform to those shown on plans, except the height shall be between 36" to 50".

Enclosure wiring shall conform to NEMA Class II C. Wiring troughs shall be provided in the enclosure as necessary. Control wiring shall be 7 strand No. 14 TW except for hinge wiring, which shall be 19 strand No. 14 THHN. Wiring shall be arranged so that any piece of apparatus may be removed without disconnecting any wiring except the leads to that piece of apparatus. Wiring lugs for field conductors shall be compatible with #2 conductors. All wiring shall be marked with permanent clip sleeve wire markers. Felt, pencil, or stick back markers will not be acceptable.

The painting process shall include five stages of metal preparation, using dip tanks as follows:

1. Alkaline cleaner.
2. Clear water rinse.
3. Phosphoric acid application.
4. Clear water rinse.
5. Inhibitive acid rinse to seal phosphated surfaces.

The finished paint coating shall be dry powder, electrostatically applied, polyurethane plastic, and then baked on at a minimum temperature of 380 ^{o} F. The finish shall conform to test method No. Calif. 645 and have a color retention of no fade after 500 hours in a fadometer. The electrostatic painted finish shall provide a minimum pencil hardness of HB and a corrosion or adhesion loss not to exceed 1/8 inch average width from a scribe mark after a minimum exposure of 500 hours to salt spray. Salt spray resistance - 500 hours. Less than 1/8 inch undercutting per ASTM - B117 adherence test method 645 - 180° bend over ¼ inch mandrel without cracking. 1,000 hours at 100 percent humidity with an X scribe mark, then apply tape and pull. Fade and chalk - 1,000 hours weatherometer and fadometer with less than 10 percent fade and chalk. The electrical equipment enclosure and the metering enclosure shall be painted a ranch green, conforming closely to Federal Standard No. 595.

Name plates shall be provided for each control component. The name plate shall be phenolic, black background with white lettering except main breaker which will be red with white lettering. All name plates will be fastened by stainless steel screws.

The Contractor shall supply all materials and perform all electrical work needed to connect the signal and lighting circuits to the utility company service. The service cabinet shall contain all the breakers shown on the Standard Drawing therfor. The enclosure shall also have a contactor

and circuit as shown in the service pedestal schematic. Each circuit breaker shall be labeled. All field wire connecting lugs shall be capable of connecting a No. 2 AWG stranded conductor.

All live wire installations shall meet the approval of the utility company. The live wire circuit from the service to the underground service meter box shall consist of conductors as specified by the servicing utility. A copy of the wiring diagram for the integrated system shall be encased in a plastic holder and mounted inside the electrical equipment enclosure.

The service cabinet base shall be concrete, integral with the sidewalk if sidewalk is being placed. The base shall be 24 inches in depth and the length and width shall be as recommended by the manufacturer. The elevation of the base in sidewalk areas shall be 2 inches above the existing, proposed or future sidewalk elevation. If no sidewalk exists, a work pad shall be provided in addition to the cabinet base. The pad shall be 3½ inches thick and extend 18 inches in front of cabinet and shall not be integral to cabinet base. Pad elevation where no future sidewalk is proposed shall be 0.1 foot above finished grade unless elevation is shown on plans or otherwise directed by the Engineer. Base elevation shall be 2 inches above pad elevation unless elevation is shown on plans. The manufacturer's bolt pattern and specifications shall be used. The concrete base shall be located as shown on the plans. One anchor bolt shall be bonded to circuit or ground wire. All conductors shall enter bottom of cabinet from underground conduiting. The meter reading opening shall face street or as directed by the Engineer.

86-22 Testing

All testing shall conform to the provisions of Section 86-2.14, “Testing,” of the State Standard Specifications and these Standard Specifications. A Certificate of Compliance shall be furnished in accordance with the provisions of Section 6-1.07, “Certificates of Compliance,” of the State Standard Specifications and Section 6-5, “Certificates of Compliance,” of these Standard Specifications certifying that all material complies in all respects to the State Standard Specifications and these Standard Specifications.

Materials Testing

Testing on materials will be performed by Independent Testing Labs. The Controller shall be capable of passing the "self-evaluation program" developed by the State of California Department of Transportation. Controllers will be tested to 160°F.

The Contractor shall deliver the controller, auxiliary equipment and controller cabinet per the City of Clovis Public Utilities Department direction. The Contractor shall allow ten (10) working days for the City of Clovis to inspect and study each unit. Call the City of Clovis Public Utilities Department 48 hours prior to delivery.

When equipment being tested has been rejected for failure to comply with specifications, the Contractor shall allow ten (10) working days for the City to retest each unit rejected. The retesting period shall begin when the corrected equipment is made available at the test site. Rejected equipment shall be replaced with new equipment by the Contractor.

All testing subsequent to rejection of the equipment for failure to comply with the specifications will be at the expense of the Contractor. Deductions to cover the cost of such testing will be made from any monies due or which may become due the Contractor under this contract. All shipping and delivery costs, including delivery to the construction site, shall be at the Contractor's expense.

In the event traffic signal equipment submitted for inspection does not comply with specifications, the Contractor shall remove said equipment for repair within three (3) working days after notification that the equipment is rejected. In the event the equipment is not removed within said period, it may be shipped to the Contractor at his expense.

Functional Testing

A City of Clovis representative and the construction Contractor or his representative shall be present at the time of initial turn-on. The following items are the responsibility of the Contractor and must be completed to the satisfaction of the City Engineer prior to signal turn-on:

1. City of Clovis Engineer must be notified in writing seven (7) working days in advance of proposed turn-on.
2. All wiring shall have been tested for shorts and continuity. Detector loops shall be megger tested and have readings that meet specifications.
3. All "field" connections shall be made.
4. All signal heads shall be properly aligned as directed by City Engineer.
5. All auxiliary functions (e.g. pedestrian signals, pedestrian push buttons, vehicle detectors, highway lighting, signs, lane lines, and pavement markings, etc.) shall be in place and operational.
6. The "Service" shall be complete including the utility company meter.

The Contractor shall allow 24 hours following the completion of the above items for the controller(s) to be delivered and installed by the City of Fresno.

The fifth paragraph in Section 86-2.14C, "Functional Testing," of the State Standard Specifications is amended to read:

> *"During the test period, the Contractor shall maintain the system or systems supplied and installed by the Contractor. The cost of any damages and maintenance, including emergency maintenance done by the City of Clovis, shall be at the Contractor's expense and shall be deducted from any monies, due or to become due the Contractor. Materials supplied by the City and installed by the Contractor as stated in the Technical Specifications shall be maintained by the City and shall be replaced or repaired by the City if damaged by public traffic. If any City supplied material is damaged by Contractor, the Contractor shall repair or replace material at his cost. The City will pay for all electrical energy for the traffic signal and highway lighting."*

86-23 Galvanizing

All galvanizing shall conform to the provisions in Section 86-2.15, "Galvanizing," of the State Standard Specifications.

86-24 Painting

Painting shall conform to the provisions in Section 86-2.16, "Painting," of the State Standard Specifications and to these Standard Specifications. Unthinned, cold, galvanized, zinc-rich paint, conforming to the requirements in Section 91, "Paint," of the State Standard Specifications, shall be used on all damaged galvanized surfaces.

All paint shall be furnished by the Contractor. Minor touch-up painting on all material whose surface is damaged or not protected from rusting shall be painted as directed by the Engineer. Painting shall be done by brush. Aerosol cans shall not be used. All salvaged, used or borrowed equipment that is reused shall be painted as stated in specifications. On signal modification

projects, all existing and reused traffic signal facilities except controller cabinets, service pedestal, poles, and luminaires shall be repainted.

86-25 Vehicle Signal Faces, Visors, And Backplates

Signal faces, signal heads and auxiliary equipment, as shown on the plans, and the installation thereof, shall conform to the provisions in Section 86-4.01, "Vehicle Signal Faces," Section 86-4.04, "Backplates," and Section 86-4.08, "Signal Mounting Assemblies," of the State Standard Specifications and these Standard Specifications.

Top openings of signal heads shall be sealed with neoprene gaskets and metal washers. If the signal head is equipped with adjustment/locking serrations, the neoprene gasket and metal washer shall be installed on the inside of the signal head.

All vehicle signal indications shall have backplates, unless otherwise indicated on the Plans. Tunnel visors shall be used with the open slot portion installed at bottom. All signal components shall be metal except for LED modules and seals. All LED modules for traffic signal units shall be supplied by the Contractor. Signal alignment shall be as directed by the Engineer.

All signal sections shall be provided with a Light Emitting Diode (LED) signal module and shall conform to the provisions in Section 86-4.02, "Light Emitting Diode Signal Module," of the State Standard Specifications, the most recent version of the California Transportation Electrical Equipment Specifications (TEES), and these Standard Specifications. All vehicular LED modules shall be Type 1 and shall be listed in the most recent California Department of Transportation Qualified Products List. The Light Emitting Diode (LED) signal module shall replace the reflector, socket, gasket and lens assembly of an incandescent signal face as specified in Section 86-4.01, "Vehicle Signal Faces," of the State Standard Specifications. Each LED unit shall consist of a convex lens made of smooth, non-refracting ultraviolet stabilized polycarbonate, the LED array, a printed circuit board, a power supply, and two conductors as specified in Section 86-4.02, "Light Emitting Diode Signal Module," of the State Standard Specifications. Each conductor shall be equipped with a quick disconnect connector. All LED modules shall have a gasket and shall be waterproof after installation and connection. <u>All green ball and green arrow LED modules shall be equipped with a clear (non-tinted) lens.</u>

The LED units shall be connected directly to 120 VAC with quick disconnect terminals. The indications shall not glow immediately after de-energization. A step down transformer shall not be used. The internal power supply shall be of a constant current design.

The LED units shall be compatible with currently used controller assemblies (i.e. solid state load switches, flashers, and "enhanced" signal monitors) without the addition of any external components.

86-26 Pedestrian Signal Faces

Pedestrian signal faces shall conform to the provisions in Section 86-4.06, "Pedestrian Signal Faces," of the State Standard Specifications and these Standard Specifications.

All pedestrian signals shall be Type A similar to the Indicator Controls Corp. Pedestrian Signal with International Symbols. All pedestrian signal components shall be metal except for LED modules and seals.

Pedestrian signal units shall be Full Symbol, MUTCD compliant, LED "Countdown" Type with 9" numerals; Gelcore Model PS7-CFF1-01A-18, or approved equal. Signal alignment shall be as directed by the Engineer.

86-27 Signal Mounting Assemblies

All signal mounting assemblies shall conform to the provisions in Section 86-4.08, "Signal Mounting Assemblies," of the State Standard Specifications and these Standard Specifications.

Mounting assemblies shall closely match the curvature of the pole. All set screws exposed to weather shall be zinc or cadmium-plated and have square heads. Mounting assemblies shall consist of bronze terminal compartments with galvanized steel conduits and ductile iron fittings. Slipfitter attachments (MAS/MAT) shall be bronze.

Where the signal heads are equipped with adjustment/locking serrations, the mating surface of the mounting hardware shall be provided with matching serrations.

Mountings shall be as stated in D.O.T. Standard Plans ES-4A, ES-4B, ES-4C, and ES-4D. Clam shell mountings shall not be used. After installation of signal facilities, if bolt threads extend more than 1 inch beyond nut, bolts shall be cut to three threads beyond nut and painted with unthinned zinc rich paint conforming to the requirements of Section 91, "Paint," of the State Standard Specifications.

All adjustable mast arm signal mountings shown on plans shall be similar to the Pelco Astro-Brac AB-3008 clamp kit using a 6 inch tenon length with a 2-3/8 inch O.D. for plumbizer mount. Installation of the Astro-Brac shall be in accordance with the manufacturer's recommendations. If the Astro-Brac tenon is removed or changed in any way, new straps shall be installed when Astro-Brac is reused or adjusted.

86-28 Accessible Pedestrian Signals

Pedestrian signals and pedestrian detectors (pushbuttons) shall conform to the accessible pedestrian signal (APS) requirements of these Technical Specifications.

86-28.1 General Description

The Accessible Pedestrian Signal System shall consist of all electronic control equipment, mounting hardware, pushbuttons, and sign which are designed to provide both a pushbutton with a raised vibrating tactile arrow on the button, along with a variety of audible sounds for different pedestrian signal functions. The System shall consist of a Control Unit and Pedestrian Pushbutton Stations, as described below.

The APS system shall be the Polara 2-wire "Navigator", or approved equal, with the following specifications:

86-28.2 Accessible pedestrian signals shall have both audible and vibrotactile walk indications.

<u>Audible Walk Indications</u>

A. Accessible pedestrian signals shall have an audible walk indication during the WALK interval only. The audible walk indication length shall be adjustable for a range of 4 seconds – 50 seconds, or the audible walk indication can be programmed to be 'on' throughout the entire WALK interval. When the pedestrian signal rests in walk, the accessible walk signal shall be capable of being recalled by a button press during the WALK interval.

B. The audible walk indication shall be by tone or by speech method.

1. Audible tone walk indications shall be a percussive tone consisting of multiple frequencies with a dominant component at 880 Hz. The tone shall repeat at 8 to 10 ticks per second, "Fast Tick". Audible tone shall be the default walk indication.
2. Speech walk messages shall be used only at locations noted on the plans or as directed by the Engineer.
3. The audible walk indication shall be set to be no more than 5 dBA louder than ambient sound except when a louder signal is provided in response to an extended button press. Automatic volumes adjustment in response to ambient traffic sound shall be provided up to a maximum volume of 100 dBA.

Vibrotactile Walk Indications

A. Vibrotactile walk indications shall be provided by a tactile arrow located on the pushbutton which vibrates during the WALK interval.

86-28.3 Accessible pedestrian signal detection shall be by means of accessible pedestrian detection push buttons.

Accessible Pedestrian Signal Pushbuttons

A. Accessible pedestrian signal pushbuttons shall clearly indicate by means of tactile arrows which crosswalk signal is actuated by each pushbutton.

1. Tactile arrows shall be located on the pushbutton.
2. Tactile arrows shall be raised .03 inch minimum and shall be 1.5 inch minimum in length.
3. Tactile arrows shall have visual contrast (light on dark or dark on light) with the background.
4. Tactile arrows shall be aligned parallel to the direction of travel on the associated crosswalk.

B. Accessible pedestrian pushbuttons shall incorporate a locator tone.

1. Pushbutton locator tones shall have a maximum duration of 0.15 seconds and shall repeat at 1-second intervals
2. Pushbutton locator tones shall be intensity responsive to ambient sound and be audible 6 feet to 12 feet from the pushbutton, or to the building line, whichever is less. Pushbutton locator tones shall be no more than 5 dBA louder than ambient sound.
3. Pushbutton locator tones shall operate during the FLASHING DON'T WALK and the DON'T WALK intervals only.
4. Pushbutton locator tones shall be deactivated during Flash operation of the traffic signals.

C. If an extended pushbutton press is used to provide any additional feature(s), a pushbutton press of less than one second shall actuate only the pedestrian timing and any associated accessible WALK signal. A pushbutton press of one second or more shall actuate the pedestrian timing, any associated accessible WALK signal, and any additional feature(s).

D. If used, a pilot light or other means of indication installed with a pedestrian pushbutton shall not be illuminated until actuation. Once it is actuated, it shall remain illuminated until the pedestrian's WALK signal indication is displayed. Each activation shall be accompanied by the speech message "Wait".

86-28.4 Street Name Information
Accessible pedestrian signals shall provide the name of the street being crossed in Grade 2 Braille format. The street name information shall be aligned parallel to the crosswalk direction.

86-28.5 Pedestrian Pushbutton Station
The Pushbutton Station provides information and cues via both a vibrating arrow button and audible sounds making the intersection accessible for all pedestrians, including those confined to wheelchairs or other wheeled transportation devices.

A. The system shall support from 2-12 pushbutton stations per intersection (maximum of 3 pushbuttons per phase) controlled by a single base unit located in the traffic control cabinet.
B. Pushbutton stations shall be able to provide the following audible features:
    1. A Pre-walk information message (as a custom feature with extended push)
    2. A "Wait" message that plays once the button is activated until the walk cycle goes into effect. This message must have the field selectable option of OFF or playing every 4, 6, 8 or 10 seconds.
    3. 5 walk sound choices (field selectable)
    4. 3 Ped-clearance sound choices including audible countdown (field selectable)
    5. Direction of travel message (as a standard feature with extended push)
    6. Multiple language capability, selectable by user (as a custom feature).
    7. Emergency preemption message in conjunction with a preemption system (selectable feature).
C. All audible sounds shall emanate from the pushbutton station.
D. Custom message IC must reside in the pushbutton station or in the control unit located in the control cabinet for easy change and/or maintenance.
E. "Walk", "Don't Walk" and "Pedestrian Clearance" audible feature must have independent settable minimum and maximum volume limits.
F. All sounds must automatically adjust to ambient noise levels over a 60 dB range.
G. All sounds for all pushbutton stations must be synchronized.
H. System must be able to provide audible countdown during ped clearance phase.
I. Pushbutton stations must require only two wires coming from the traffic control cabinet for each phase / crosswalk.
J. Pushbutton stations shall be capable of functioning using a three conductor cable run to each corner of the intersection, with one common wire shared with two different pedestrian phases.
K. Pushbutton shall be ADA and MUTCD compliant.
L. Each pushbutton station must have a 2" cast aluminum button with an aluminum tactile raised directional arrow on the button.
M. The arrow on the pushbutton shall be able to be changed to one of four directions.
N. The arrow/button shall vibrate during the walk period, following a button push.
O. Pushbutton station frame shall be made of cast aluminum with mounting holes to hold a 5"x7¾" or larger pedestrian sign.
P. All pushbutton volumes and optional features shall be programmed at the push button using Infrared device with password security
Q. Pushbutton shall have the option to mute sounds on all crosswalks except activated crosswalk (selectable feature).
R. Each pushbutton Station shall have a unique ID for self test and failsafe capabilities.
S. Accessible pedestrian push buttons shall be located on traffic signal poles at the locations shown on the plans. The typical mounting height shall be 36" to the center of the pushbutton as measured from the curb landing (sidewalk) surface, or from the street

surface surrounding a pole located in a median island nose. Median island push buttons, if used, shall be placed no further than 24 inches horizontally from the path of travel for disabled persons.

T. Pedestrian Push Button Stations shall be identified at each location with a 2-inch wide textured yellow tape placed around the circumference of the pole on which the station is installed, immediately above the station. A 1-inch wide dark (black) tape strip shall be placed immediately above and below the yellow tape around the circumference of the pole.

86-28.6 Central Control Unit (CCU)

The CCU is the power supply and control unit that provides power and data to the push button stations.

A. Shall be installed inside the Traffic Cabinet and be powered by the AC supply mains (115 VAC).
B. Shall control up to 12 Push Button Stations in a maximum of 4 phases up to 3 push buttons per phase.
C. Shall control up to four Pedestrian phases, receiving its timing from the Walk and Don't Walk signals.
D. Shall be able to self test all buttons, report any faults to traffic controller, and put a phase into recall should a push button fail the self test.
E. Shall provide general purpose inputs optically isolated 10-36 volts AC/DC Peak 10 mA maximum.
F. Shall be provided with a 4-cable interface harness assembly.
G. Shall be provided with an interface connection board with relays that when wired in conjunction with the CCU provides failsafe protection should any of the CCU channels fail.

86-29 Light-Emitting Diode (LED) Luminaires

All new installed street light luminaires shall be PG&E approved type LED as specified on the construction specifications, construction plans, and/or as directed by the Engineer.

86-30 High Pressure Luminaires, Sodium Lamps, Lamp Ballasts and Photoelectric Controls

High pressure sodium luminaires shall conform to the provisions in Section 86-6.01, "High Pressure Sodium Luminaires," of the State Standard Specifications and these Standard Specifications. Luminaire voltage shall be 120 volts.

Each luminaire shall be provided with an internal ballast assembly (including ballast, capacitor, and lamp starter unit) mounted on a down opening door. The door shall be hinged to the luminaire housing and secured separately from the refractor door, and shall be easily removable and replaceable. All connections from the ballast assembly shall be made with a single multi-circuit connector or individual color-coded NEMA tab connectors. Field connections to the luminaire shall terminate on a barrier-type terminal block secured to the housing.

Intersection safety lighting luminaires shall be 150 watt high pressure sodium, or PG&E approved LED equivalent, with filtered optics and shall be equal or better than General Electric's M-250-A2 power/door cutoff No. M2AC15S1N2GMC32 and shall have a Type III distribution. Luminaires shall be the cutoff type.

High pressure sodium lamps shall conform to the provisions in Section 86-6.01B, "High Pressure Sodium Lamps," of the State Standard Specifications.

Ballasts shall conform to the provisions in Section 86-6.01A, "High Pressure Sodium Lamp Ballasts," and Section 86-6.01A(1), "Regulator Type Ballasts," of the State Standard Specifications and these Specifications. Attention is called to Section 86-2.095, "Fused Spliced Connectors," of the State Standard Specifications.

Integral regulator-type ballasts (lag type) shall be provided. Luminaire ballast fusing shall be as stated in State Standard Plans Sheet ES-13B. Fuses shall be placed in adjacent pull box. Fuse shall be installed on ungrounded conductor. Fuse shall be retained in load side of holder when disconnected.

Photoelectric Controls shall conform to the provisions in Section 86-6.07, "Photo Electric Controls," of the State Standard Specifications and these Standard Specifications, and shall be Type II.

The photoelectric control (PEC) shall be mounted atop the pole identified in the plans using an adapter manufactured for that purpose. The Control will be wired back to the service pedestal using three #12 stranded type THHN conductors color coded to match the PEC. The safety lighting PEC socket shall have a low profile shorting cap installed.

The supply voltage rating for photoelectric units shall be 60HZ, 105-240 volts. The photoelectric window shall be oriented to the north.

86-31 Removing Electrical Equipment

Removing electrical equipment shall conform to the provisions in Section 86-7.01, "Removing Electrical Equipment," of the State Standard Specifications and these Standard Specifications.

86-32 Reinstalling Removed Electrical Equipment

Reinstalling removed electrical equipment shall conform to the provisions in Section 86-7.02, "Reinstalling Removed Electrical Equipment," of the State Standard Specifications.

86-33 Stockpiling Salvaged Electrical Equipment

Existing equipment removed and not reused shall be salvaged and shall be stockpiled in a safe protected place. The Contractor shall include in his bid for the delivery of all salvaged equipment. The salvaged equipment shall be delivered to the City of Clovis Corporation Yard, 908 Villa Avenue, Clovis, California. A written inventory of all salvaged material delivered shall be given to the project inspector.

86-34 Red Light Enforcement Indicators

A "Red Light Enforcement Indicator" is a device to allow traffic enforcement officers to monitor traffic signal RED light status from convenient locations other than from directly in front of the signal head. Red Light Enforcement Indicators shall be the McCain "Enforcer" Unit or other approved equal.

The device is connected to the RED vehicle signal indicator wiring. The enforcement indicator will be activated only when the RED vehicle signal indicator is energized. The device shall consist of RED LEDs installed in a barrel (sun visor). The barrel/sun visor is to be rotatable and adjustable both vertically and horizontally to permit the device to be aimed at a specific viewing location. The enforcement indicator's wiring is to be connected to the standard traffic signal terminal block with spade connectors, or as approved by the Engineer.

86-35 Vehicle Detectors

Detectors shall conform to the provisions in Section 86-3.01, "Controller Assemblies," and Section 86-3.03, "Model 170 and Model 2070 Controller Assemblies," as contained in the latest edition of the Traffic Signal Control Equipment Specifications of the State of California Department of Transportation, and Section 86-5.01, "Vehicle Detectors," of the State Standard Specifications and these Standard Specifications.

The detector amplifiers shall be two-channel loop detector sensor unit Model 222, and two-channel magnetic detector sensor unit model 232. When using video detection equipment, model 222 loop detector sensor units shall be replaced with 2-channel model 242 isolators. Magnetic detector sensing elements (probes) shall be model 231. Probes and amplifiers shall be compatible. The model 222 loop detector sensor units shall be capable of operating 4 - 6' x 6' loop detectors connected in series in the adjacent pull box and installed as shown on plans. Probes and magnetic detector circuit shall not be megger tested.

86-36 Loop Detector Installation Procedure

1. All loop detectors shall be installed as shown on the Plans. If loop detectors are to be installed in PVC, the conductors shall be installed in ¾ inch Schedule 40 PVC conduit and installed as shown on the plans. PVC encased loop detectors shall measure 6 ft x 6 ft, or as shown on the plans. All other loop detectors shall be installed as shown in the most recent edition of the State of California Standard Plans ES-5A and ES-5B, and in conformance with these Specifications.
2. Supply and install a termination pull box with extension as shown in the "Type A" Curb Termination Details and shoulder termination drawings in these Special Provisions and in accordance with the most recent edition of the State of California Standard Plans ES-5D.
3. Each loop detector shall consist of three turns (or as shown on the plans) of stranded copper wire, 12 AWG for PVC loops and 14 AWG for sawcut loops. Type 1 loop conductors (PVC encased) shall have Type USE insulation (600 volt). Type 2 loop conductors (sawcut loops) shall conform to IMSA 51-5 or IMSA 51-7 specifications. Each loop detector shall have a separate lead-in to the termination pull box.
4. Loop conductors shall be wound and labeled as depicted on Standard Plans ES-5A. The word "top" shall be placed on the top side of each PVC loop for correct installation. (The top side is the side with the condulet cover.)
5. Allow additional length of each conductor for the run to the termination pull box plus five feet of slack.
6. Each pair of loop lead-in conductors shall be twisted together at the rate of two turns per foot from the loop detector in the roadway to the point of connection with the DLC cable in the termination pull box.
7. Identify and tag each DLC cable in the termination pull box with the loop assignment designation shown on the plans. Include the phase number and the input slot assignment on the tags. Tags shall be plastic and attached to the cable with non-metallic permanent fasteners. Each pair of loop lead-in conductors shall be tagged as above. Also tag the loop conductors with start (S) and finish (F).
8. Identify and tag each DLC cable in the controller cabinet with the loop assignment designation shown on the plans.
9. All loop detectors and loop detector circuits shall be meg tested at 500v and shall test not less than 100 megohms from phase to ground. Each loop shall be continuity tested and meg tested at the termination pull box in the presence of the Engineer prior to splicing. Test each loop circuit for continuity, circuit resistance, and insulation resistance at the controller cabinet location. The loop circuit resistance shall not exceed 0.5 ohms plus 0.35 ohms per 100 feet of lead-in cable. The loop test measurements shall be

documented on the "Loop Detector Test Results" form provided in these technical specifications. The form will be signed and dated by the individual performing the tests, as well as by the Engineer.

10. Supply and install Type "C" lead-in cable (IMSA 50-2). Within the detector lead-in cable the conductor with the white insulation shall always be installed above the conductor with the black insulation for each phase on the terminal strip within the controller cabinet. The lead-in cable shall not be spliced between the loop detector termination pull box and the controller cabinet terminal strip. Cable for the advance left turn detector may be spliced at two locations: Once at the advance loop lead-in pull box and once at the termination pull box for the near left turn loop detectors. The ends of the lead-in cables and the Type 2 loop wires shall be waterproofed to prevent moisture from entering.
11. After all tests and installation procedures have satisfied the requirements stated in these Specifications, the Contract Specifications, Standard Plans, and Construction Drawings, the Contractor shall make the final connections in the termination pull box. Current flow within each loop shall be as shown on the standard Plans ES-5A.
12. Magnetic vehicle detectors shall not be meg tested.
13. Connections shall be made using uninsulated in-line splices and soldered using Rosin Core solder. No open flame soldering shall be allowed. After soldering, the Contractor shall insulate the splices per Section 86-2.09E, "Splice Insulation," of the State Standard Specifications.
14. The Contractor may use either of the following splice insulation options:
    (a) "Method B" as shown on the State of California Standard Plans ES-13A, followed with an outer layer of friction tape and covered with an approved electrical insulating coating.
    (b) Heat-shrink tubing as provided in the State Standard Specifications Section 86-2.09E, "Splice Insulation." When three or more conductors are to be enclosed within a single splice using heat-shrink tubing, mastic shall be placed around each conductor prior to being placed inside the heat-shrink tubing. The mastic shall be the type recommended by the manufacturer of the heat-shrink tubing.
15. The distance between the side of a loop and the loop lead-in from an adjacent detector shall be 24 inches minimum. The distance between loop lead-ins shall be 6 inches minimum. Loops placed during new pavement construction shall be placed prior to the final lift of AC or AC overlay. The top of PVC loops shall be 0.1 ft below the top of base rock or dirt and shall be held in position by installing a wooden stake in each corner.
16. Multiple loop detectors connected to a single loop lead-in cable shall be connected in series.
17. The slots for sawcut loop installations shall be filled using hot melt rubberized asphalt sealant that conforms to Section 86-5.01A(5), "Installation Details" of the State Standard Specifications.
18. The loop test measurements as detailed in the Standard Plans ES-5A, Installation Details, note #17 shall be documented on the "Loop Detector Test Results" form provided in these technical specifications. The form shall be signed and dated by the individual performing the tests, as well as by the Engineer, and shall be placed in the controller cabinet.

86-37 Sawcut Loop Detector Installation

Loop detector installation shall conform to the provisions in Section 86-5.01A(5), "Installation Details," of the State Standard Specifications. Loop detector conductors installed in the surface of a new or existing roadway shall be placed in a sawcut slot as shown in ES-5A and ES-5B of

the State Standard Plans. The slots shall be dry and clean from all dirt and debris and shall be filled with hot-melt rubberized asphalt sealant after the conductors have been installed.

86-38 PVC Loop Detector Slot Patching Procedure

PVC loop detector slots shall be dry and clean from all dirt and debris. Asphaltic emulsion (paint binder) shall be sprayed on all surfaces of the slot in accordance with the provisions in Section 39-4.02, "Prime Coat and Paint Binder (Tack Coat)," of the State Standard Specifications.

Asphalt binder shall be liquid asphalt, grade SC-800 in conformance with Section 93, "Liquid Asphalts," of the State Standard Specifications.

Patch mix asphalt concrete shall be placed in the slot. The slot shall be filled and compacted with a pneumatic tamper until crown is slightly above the existing surface and to the same width as the slot. The minimum thickness of asphalt concrete shall be 2.5 inches. Excess asphalt concrete remaining shall not be used and shall be removed from roadway. Patch mix asphalt concrete shall be Type B (½ inch maximum, coarse); shall conform to the provisions in Section 39-2, "Materials," and Section 39-3, "Storing, Proportioning, and Mixing Materials," of the State Standard Specifications and the Contract Specifications; <u>and shall include treatment by heater remix</u>, as shown on the applicable City Standard Drawing for Trench Resurfacing. All slot patching shall be slurry sealed with a Type "II" slurry as the last order of work for the loop slot patch operation.

The supplier shall furnish, without charge, samples of all materials entering into the work, and no material shall be used prior to approval by the Engineer.

Samples of material from local sources shall be taken by or in the presence of the Engineer, otherwise the samples will not be considered for testing.

86-39 Magnetic Detector Installation Procedure

1. Supply and install a No. 5E pull box with extension at each end of the 3 inch P.V.C. conduit at the location shown on the plans. The longest dimension of the pull box shall be parallel to the P.V.C. conduit.
2. Sawcut and trench between the two No. 5E pull boxes. Bottom of trench shall be 12 inches below finished grade (see sheet ES-5C of State Standard Plans).
3. Supply and install a 3 inch P.V.C. schedule 40 conduit in slot and into pull box on each end. Conduit shall extend not more than 2 inches inside the pull box wall. P.V.C. bushings shall be installed on each end of this conduit prior to installation of the probes.
4. Backfill the trench with a 2-sack concrete sand slurry to a depth of not less than 2.5 inches below the pavement surface. Complete backfill operations in existing pavement as stated in Section 86.40, "PVC Loop Detector Slot Patching Procedure" of these specifications.
5. Install Model 231 sensing elements (probes) as shown on plans and as stated in these Specifications. Connections shall be made as shown on the drawings included in these Technical Specifications. A polyethylene braided rope having a minimum diameter of 3/16 inch shall be installed to facilitate proper positioning and removal of the probe(s). Only a single pull rope shall be used, regardless of the number of probes installed. The rope shall be tied to the probe(s) in two locations and taped to the probe(s) in three locations. A minimum of 3 feet of rope shall be left in the lead-in cable pull box. The ends of the pull rope shall be secured to the conduit. At the pull box not containing the

probe lead-in and the DLC cables, the excess pull rope shall be of sufficient length to reach back across the roadway to the opposite side pull box.

6. Probe lead-in conductors shall be continuous without splices from probe to adjacent pull box. Excess probe lead-in conductor slack shall not be cut or removed. Probe and lead-in conductors shall not be megger tested.
7. Supply and install Type "C" lead-in cable from the pull box adjacent to the probes to the field terminals in the 332 controller cabinet. Within the controller cabinet, identify and tag each DLC cable with the loop assignment designation shown on the plans. The cable shall be the same type specified for inductive loop detectors. Within the detector lead-in cable, the conductor with the white insulation shall always be installed above the conductor with the black insulation for each phase on the terminal strip within the controller cabinet. Cable shall be continuous without splices from pull box adjacent to probe to controller cabinet.
8. Splices in pull box adjacent to probes shall be in-line splices and soldered using Rosen-Core solder. No open flame soldering shall be allowed.
9. The Contractor shall insulate splices as stated in the State Standard Specifications Section 86-2.09E, "Splice Insulation," and Section 86-38, "Loop Detector Installation Procedure," of these Specifications. The ends of the lead-in cable shall be taped and waterproofed to prevent moisture from entering cable.
10. Identify and tag circuit pairs in the pull box adjacent to the probes. Identify and tag with probe number as shown on plans in detector assignment schedule - slot column. Identify and tag lead-in cable with sensor number and phase as shown on plans. Tags shall be plastic and attached to cable with a non-ferrous permanent fastener.
11. Magnetic detector circuits shall not be megger tested.

86-40 Magnetic Detector Connections

The intermediate and far magnetic detectors shall be connected as shown on the magnetic detector probe connection diagrams attached to these Standard Specifications. If more than one probe for far or intermediate detection is used and is connected to one lead-in cable, these probes shall be connected in parallel.

86-41 Solid State Traffic Actuated Controllers

A Type 170 E controller assembly which includes a controller unit, controller components, and completely wired controller cabinet shall be supplied and installed by the Contractor. This material shall conform to the provisions in the State Standard Specifications Section 86-3, "Controller Assemblies," and the following:

1. The 170 E controller unit and the 332A cabinet shall be an 8-phase unit.
2. The controller shall be supplied with a Model 412C program module configured for 'Memory Select 4' per paragraph 2.4.2.2.2 of the Transportation Electrical Equipment Specifications dated March 29, 2002. This program module shall be fully loaded with proms as specified by Caltrans. All Microprocessor Units (MPU) furnished in the Model 170E controller and the Model 412C Program Module shall properly execute existing object programs developed to operate with a Motorola 6800 or 6802 MPU. This equipment will be subject to testing and inspection at the City of Fresno test facilities. The Model 170E controller will be tested to 160° F and must pass the CALTRANS Diagnostic and Acceptance Test Program Ver 2.4.11 dated September, 1999. The Model 412C Program Module shall be fully populated. The U1 Eprom shall be unprogrammed (blank).
3. All controller programming (software) shall be provided by the City.

4. Each controller shall be capable of passing the "Self-Evaluation Program" developed by the State of California Department of Transportation.
5. All controllers supplied shall comply with State Law AB3418 requiring compatibility with NTCIP data protocol.
6. Controller shall be supplied by companies on the latest issue of the approved Qualified Products List (QPL).

The Contractor shall arrange for the controller, controller components, and the controller cabinet to be delivered to the City of Fresno Traffic Signal Maintenance Shop, 2101 "G" Street, Fresno, CA 93706. After testing by the City of Fresno, the Contractor shall pick up the controller cabinet(s). Contact the Traffic Signal Supervisor at (559) 621-1492 at least 48 hrs prior to pick up or delivery. Cost of picking up the cabinet shall be included in bid. The City of Fresno shall deliver and install the controller and components at time of signal turn-on. The Contractor shall give the City of Clovis and the City of Fresno Traffic Signal Maintenance Division seven (7) days notice prior to signal turn-on. All initial testing by the City of Fresno shall be paid by the City of Clovis. Retests shall be the responsibility of the Contractor.

86-42 Controller Cabinet

The controller cabinet(s) supplied by the Contractor shall conform to the provisions in Section 86-3, "Controller Assemblies," of the State Standard Specifications and these Standard Specifications. Material and equipment must comply with the latest plans and specifications of the State of California Department of Transportation and must be supplied by companies on the latest issue of the approved Qualified Products List (QPL).

The cabinet shall be Type 332A and shall be constructed of anodized aluminum and in accordance with the State of California D.O.T. Traffic Signal Control Equipment Specifications dated January 1989, or latest issue. All signal components shall be installed on a removable rack. All space connectors shall be soldered to wire. The cabinet shall be sealed to foundation as stated in Note No. 15 on Sheet ES-3C of the latest edition of the State Standard Plans. The Police Panel door shall face the street.

The cabinet shall be equipped with a Signal Monitor Unit with the following features:

1. A Model 210 "enhanced" Signal Monitor as manufactured by Eberle Design Incorporated, EDI Model 2010ECL or approved equal, shall be supplied and installed in the controller cabinet.
2. The Contractor shall supply and install a 16-channel monitor with harness. This monitor shall be a self-contained compact device capable of being installed in the existing slot designed for the Model 210 monitor located in the output file of the 332A cabinet. This Monitor shall utilize the existing connections for the Model 210 monitor, plus a harness connection on the front panel.
3. The front panel connector will not correspond to the Model 210 monitor or the NEMA monitor specifications. This connector and harness shall only contain the monitoring circuits used for monitoring the enhanced features. The Monitor shall be capable of performing all the functions of a Model 210 monitor with the front panel harness disconnected.
4. The Monitor shall be designed to adapt RED SIGNAL MONITORING to the conventional Model 332A controller cabinet. The Monitor shall be directly interchangeable with the standard 210 via the rear edge card connector and shall be designed to meet all the state specifications governing the regular 210 monitor. The Monitor shall also be capable of monitoring for the absence of a signal (i.e. dark signal head), other combinations of incorrect signals, and Yellow timing.

5. This Monitor shall be a microprocessor based signal monitor. This 170/2070 series Monitor shall have the capability to handle up to 16 channels with three inputs per channel. The unit shall have three other monitoring functions, a watchdog monitor which can be deselected, a 24 VDC monitor, and an AC line voltage monitor. A diagnostic capability shall be available for troubleshooting. This Monitor shall be capable of monitoring a Yellow signal which is shorter than the required time (2.7 seconds plus DIP switch setting) and shall engage the fault relay and display the faulted channel. If the Yellow phase is skipped, a fault will be indicated. The PCA (Program Card Ajar) indicator shall illuminate if no program card is present or improperly seated. The PIAF indicator shall indicate that a power interruption has occurred after a fault was indicated. The current display shall indicate the failed channels at the time the fault occurred.
6. The Monitor shall have switches that are selectable individually on a per-channel basis via DIP switches located behind the front panel. When the Enhanced feature for a particular channel is enabled the three inputs (Green, Yellow, and Red) comprising that channel will be monitored for a proper display; i.e. one of the three inputs must be active at all times and only one input may be active at any given time. The Red Fail indicator will illuminate only when a total absence of input signals on a channel is detected. The Switch Fail indicator will illuminate only if the Enhanced feature is enabled for a given channel and more than one signal is detected simultaneously.
7. The flashing operation of this Monitor shall lock in and shall release only upon operation of a reset switch. However, if there is a complete failure of power to the controller assembly, the lock-in shall release unless a conflict precedes a complete power failure. This shall place the Monitor in flash operation until reset switch is reset.
8. A parts layout, schematic diagram, parts list, and theory of operation shall be supplied with the Monitor.
9. The Monitor furnished under this specification, shall be the most improved model, past the development stage and in the factory production.
10. The Monitor shall be functionally wired to utilize its maximum capacity, i.e. absence of Red, +24 V.D.C. Watchdog Monitor, etc.
11. A Red signal input on the Monitor shall be sensed when it exceeds 70 VAC RMS and a Red signal input shall not be sensed when it is less than 50 VAC RMS. Red signals between 50 and 70 VAC RMS may or may not be sensed.
12. A Green or Yellow signal input on the Monitor shall be sensed when it exceeds 25 VAC RMS and a Green or Yellow signal input shall not be sensed when it is less than 15 VAC RMS. Green or Yellow signals between 15 and 25 VAC RMS may or may not be sensed.
13. The Monitor shall place the controller in stop timing mode when a conflict occurs and when the following circuits malfunction: Red signal output, microprocessor, and power supply voltages. The Monitor shall not register a conflict due to the controller being in RR-1 or due to monitoring the pedestrian flashing Don't Walk.
14. The Monitor shall be fully guaranteed to perform satisfactory as specified in these specifications and special provisions for a period of two years from date of acceptance by the City of Clovis. The testing of this Monitor shall conform to the provisions of Section 86-2.14, "Testing," of the State Standard Specifications and these Specifications.
15. The Monitor shall provide for full simultaneous R-Y-G intersection display by means of front panel Red, Yellow, and Green LED inputs to each channel.
16. The Monitor shall have a simple diagnostic mode to provide the signal status for the previous two faults without the aid of a PC.
17. Data logging capabilities shall include four event log types:

(a) Previous Failure Log shall record field signal voltages, control signal voltages, and cabinet temperature, all stamped with the time and date of the event, up to 25 events.
(b) Monitor Reset Log shall document and time stamp the entry to flash and the exit from flash, up to 25 events.
(c) AC Line Log shall record any AC Line events (power down, short interrupt, and brownout) which cause the Monitor to transfer to Flash operation, and shall record the line voltage, up to 40 events.
(d) Configuration Change Log records any change to the diode matrix, switches, or jumper selection, up to 10 events.

All events shall be sorted by time and date to enable them to be viewed in the real time line in which they occurred. Diagnostic software for this purpose shall be available from the signal monitor manufacturer. The controller cabinet temperature shall be recorded in all fault event records, as well as in the real time mode.

18. The Monitor shall provide a selectable Minimum Flash Time option to enable it to be compatible with the Model 2070 controller. This selectable flash interval shall be at least 6 seconds and no more than 10 seconds in duration following a power-up, an AC Line interruption, or a brownout restore. During this interval the unit will suspend all fault monitoring functions and close the Output relay contacts. The Minimum Flash Interval will be terminated after at least 6 seconds if the Watchdog input has made 5 transitions between the True and False state and the AC Line voltage is greater than the restore level.
19. The Monitor shall be compatible with the MT-180 Monitor Tester.
20. The Monitor shall be equipped with an EIA-232 serial link to provide access with a computer for status, event log review, and archival. The Monitor shall also be compatible with the BiTran Systems 233 Software to update the Controller Unit with monitor status and automatically synchronize the Monitor clock and calendar.

The Model 332A cabinet shall be lockable and shall include the following components:

Model No. 200 Switch Packs.
Model No. 222 2-Channel Loop Detector Amplifiers.
Model No. 232 2-Channel Magnetic Probe Detector Amplifiers.
Model No. 242 2-Channel DC Isolators.
Model No. 752 Emergency Vehicle Preemption Discriminator(s).

Refer to the Project Plans to determine the quantity of each component to be supplied.

The Model 332A controller cabinet shall contain the power supply (PDA 2), two Model 204 flashers, all necessary relays, the Conflict Monitor, a red interface adaptor, a thermostatically controlled exhaust fan, a door switch operated fluorescent light, a slide out shelf/drawer storage unit, and four anchor bolts.

All crimp type connectors between the Lower Input Panel and the Input File shall be soldered.

All 15 amp and 20 amp circuit breakers shall be short delay. For example, Potter and Brumfield Curve 3, or Carling switch Delay 22.

The locking system shall be a Corbin 3-point system. The lock shall be a Corbin #2, keyed alike to be compatible with the controller cabinet locks currently in use throughout the City of Clovis.

The Model No. 231 sensing element shall be compatible with the Model No. 232 2-channel magnetic detector amplifier (M-Systems Model No. 231 sensing elements (probes) are approved). Terminal blocks shall be provided for terminating the field connectors. Lugs shall be connected to field connectors and soldered prior to connecting to terminal blocks.

86-43 Auxiliary Equipment

All components shall conform to the provisions in Section 86-3, "Controller Assemblies," of the State Standard Specifications.

86-44 Modulated Light Signal Detection System

The modulated light signal detection system shall conform to the details shown on the Plans and these special provisions. The Opticom™ 700 series (or better) produced by 3M™ is the only system approved. All components of the Opticom™ system shall be matched system components produced by the 3M™ Company (includes data-encoded emitter, optical detector, optical detector cable and data-encoded phase selector).

Information on Opticom™ equipment can be obtained by contacting the following or contact the local authorized 3M™ products distributor:

Advance Traffic Products, Inc.
909 SE Everett Mall Way, Suite B280
Everett, WA 98208-3740
TEL: (425) 347-6208, FAX: (425) 347-6308

A. GENERAL

Each modulated light signal detection system shall consist of an optical emitter assembly or assemblies located on the appropriate vehicle and an optical detector/discriminator assembly or assemblies located at the traffic signal and auxiliary/phase sense harnesses.

Each system shall permit detection of two classes of authorized vehicles. Class I (mass transit) vehicles shall be capable of being detected at any range of up to 2,500 feet from the optical detector. Class II (emergency) vehicles shall be capable of being detected at any range up to 2,500 feet from the optical detector. Each system shall have data-encoded phase selectors.

Class I signals (those emitted by Class I vehicles) shall be distinguished from Class II signals (those emitted by Class II vehicles) on the basis of the modulation frequency of the light from the respective emitter. The modulation frequency for Class I signal emitters shall be 9.639 Hz ± 0.110 Hz. The modulation frequency for Class II signal emitters shall be 14.035 Hz ± 0.250 Hz.

A system shall establish a priority of Class II vehicle signals over Class I vehicle signals and shall conform to the requirements in Section 25352 of the California Vehicle Code.

B. EMITTER ASSEMBLY

Each emitter assembly shall consist of a data-encoded optical emitter unit, an emitter control unit, and connecting cables and shall conform to the following:

1. General - Each emitter assembly, including lamp, shall be designed to operate over an ambient temperature range of -34° C (-30° F) to 60° C (140° F) at both modulation

frequencies and to operate continuously at the higher frequency for a minimum of 3,000 hours at 25° C (77° F) ambient before failure of the lamp or any other component.

Each emitter unit shall be controlled by a single, maintained-contact switch on the respective emitter control unit. The switch shall be capable of being located to be readily accessible to the vehicle driver. The control unit shall contain a pilot light to indicate that the emitter power circuit is energized and shall be capable of generating only one modulating code, either that for Class I vehicles or that for Class II vehicles.

2. Functional - Each emitter unit shall transmit optical energy in one direction only.

3. Electrical - Each emitter assembly shall be capable of providing full light output with input (vehicle battery) voltages of between 10 and 16 volts DC. An emitter assembly shall not be damaged by input voltages up to 7.5 volts DC above supply voltage. The emitter assembly shall not generate voltage transients on the input supply which exceed the supply voltage by more than 4 volts.

   Each emitter assembly shall consume not more than 100 watts at 17.5 volts DC and shall have a power input circuit breaker rated at 10 to 12 amperes, 12 volts DC. The design and circuitry of each emitter shall permit its use on vehicles with either negative or positive ground without disassembling or rewiring of the unit.

4. Mechanical - Each emitter unit shall be housed in a weatherproof corrosion-resistant housing. The housing shall be provided with facilities to permit mounting on various types of vehicles and shall have provision for aligning the emitter unit properly and for locking the emitter unit into this alignment.
   Each emitter control unit shall be provided with hardware to permit its mounting in or on an emergency vehicle or mass transit vehicles. Where required for certain emergency vehicles, the emitter control unit and all exposed controls shall be weatherproof.

C. OPTICAL DETECTION/DISCRIMINATOR ASSEMBLY
Optical detection/data-encoded phase selector discriminator assembly shall conform to the following:

1. General - Each optical detection/discriminator assembly shall consist of one or more optical detectors, connecting cable and a discriminator module.

2. Optical Detector -- Each optical detector shall be a weatherproof unit capable of receiving optical energy from two separately amiable directions. The horizontal angle between the two directions shall be variable from 180° to 5°.

   The reception angle for each photocell assembly shall be a maximum of 8° in all directions about the aiming axis of the assembly. Measurements of reception angle will be taken at a range of 1,000 feet for a Type I emitter and at a range of 1,800 feet for a Type II emitter.

   All internal circuitry shall be solid state, and electrical power shall be provided by the associated discriminator module. Each optical detector shall be installed, wired, and aimed as specified by the manufacturer and as shown in the details and diagrams.

Each optical detector shall be contained in a housing, which shall include two rotatable photocell assemblies, an electronic assembly, and a base. The base shall have an opening to permit its mounting on a mast arm or a vertical pipe nipple, or suspension from a span wire. The mounting opening shall have female threads for 3/4 inch conduit. A cable entrance shall be provided which shall have male threads and gasketing to permit a waterproof cable connection. Each detector shall weigh not more than 1 1/2 pounds and shall present a maximum wind load area of 36 square inches. The housing shall be provided with weep holes to permit drainage of condensed moisture.

3. Cable - Optical detector cable shall meet the requirements of IPCEA-S-61-402/NEMA WC 5, Section 7.4, 600 volt control cable, 75° C., Type B, and the following:

   (a) The cable shall contain 3 conductors, each of which shall be No. 20 (7 x 28) stranded, tinned copper with low-density polyethylene insulation. Minimum average insulation thickness shall be 25 mils. Insulation of individual conductors shall be color coded: 1-yellow, 1-blue, and 1-orange.
   (b) The shield shall be either tinned cooper braid or aluminized polyester film with a nominal 20 percent overlap. Where the film is used, a No. 20 (7 x 28) stranded, tinned, bare drain wire shall be placed between the insulated conductors and the shield and in contact with the conductive surface of the shield.
   (c) The jacket shall be black polyvinyl chloride with minimum ratings of 600 volts and 176° F and a minimum average thickness of 45 mils. The jacket shall be marked as required by IPCEA/NEMA.
   (d) The finished outside diameter of the cable shall not exceed 0.35 inch.
   (e) The capacitance, as measured between any conductor and the other conductors and the shield, shall not exceed 48 picofarads per foot at 1,000 Hz.
   (f) The cable run between each detector and the controller cabinet shall be continuous without splices or shall be spliced only as directed by the detector manufacturer.

4. Data-Encoded Discriminator/Phase Selector Module -- Each data-encoded discriminator/phase selector module shall be designed to be compatible and usable with a Model 170E controller unit and to be mounted in the input file of a Model 332 controller cabinet, and shall conform to the requirements of Chapter I of the State of California, Department of Transportation, "Traffic Signal Control Equipment Specifications," dated April 1978, and to all addendums thereto current at the time of project advertising.

   Each discriminator module shall be capable of operating two channels, each of which shall provide an independent output for each separate input. Each discriminator module, which used with its associated detectors, shall be capable of:

   (a) Receiving Class I signals at a range of up to 1,000 feet and Class II signals at a range of up to 1,800 feet.
   (b) Decoding the signals, on the basis of frequency, at 9.639 Hz ± 0.119 Hz for Class I signals and 14.035 Hz ± 0.255 Hz for Class II signals.
   (c) Establishing the validity of received signals on the basis of frequency and length of time received. A signal shall be considered valid only when received for more than 0.50 second. No combination of Class I signals shall be recognized as a Class II signal regardless of the number of signals being received, up to a maximum of ten

signals. Once a valid signal has been recognized, its effect shall be held by the module in the event of temporary loss of the signal for a period adjustable from 4.5 seconds to 11 seconds in at least 2 steps at 5 seconds ± 0.5 second and 10 seconds ± 0.5 second.

(d) Providing an output for each channel that will result in a "low" or grounded condition of the appropriate input of a Model 170 controller unit. For Class I signals, the output shall be a 6.25 Hz ± 0.1 percent, rectangular waveform with a 50 percent duty cycle. For Class II signals, the output shall be steady.

Each discriminator module shall receive electric power from the controller cabinet at either 24 volts DC or 120 volts AC. Each channel together with its associated detectors shall draw not more than 100 milliamperes at 24 volts DC or more than 100 milliamperes at 120 volts AC. Electric power, one detector input for each channel and one output for each channel, shall terminate at the printed circuit board edge connector pins listed below.

Board edge connector pin assignment shall be as follows:

A	DC ground		
B	+24 VDC	P	NC
C	NC		
D	Detector input, Channel A	R	NC
E	+24 VDC to detectors	S	NC
F	Channel A output (C)	T	NC
		U	NC
H	Channel A output (E)	V	NC
J	Detector input, Channel B	W	Channel B output (C)
K	DC ground to detectors	X	Channel B output (E)
L	Chassis ground	Y	NC
M	AC-	Z	NC
N	AC+		

( ) Slotted for Keying

(NC) not connected; cannot be used by manufacturer for any purpose.

(C) Collector
(E) Emitter

Two auxiliary inputs for each channel shall enter each module through the front panel connector.

1. Auxiliary detector 1 input, Channel A
2. Auxiliary detector 2 input, Channel A
3. Auxiliary detector 1 input, Channel B
4. Auxiliary detector 2 input, Channel B

Each channel output shall be an optically isolated NPN open collector transistor capable of sinking 50 milliamperes at 30 volts and shall be compatible with the Model 170 controller unit inputs.

Each discriminator module shall be provided with means of preventing transients received by the detector from affecting the Model 170 controller assembly. Each

discriminator module shall have a single connector board, shall be capable of being inserted into the input file of a Model 332 cabinet and shall occupy one slot width of the input file. The front panel of each module shall have a handle, to facilitate withdrawal, and the following controls and indicators for each channel:

(a) A "signal" indication and a "call" indication each for Class I and for Class II signals. The "signal" indication denotes that a signal above the threshold level has been received. A "call" indication denotes that a steady, validly coded signal has been received. These two indications may be accomplished with a single indication lamp; "signal" being denoted by a flashing indication and "call" with a steady indication.

5. Cabinet Wiring - The Model 332 cabinet has provisions for connections between the optical detectors, the discriminator module, and the model 170 controller unit.

Wiring for a Model 332 cabinet shall conform to the following:

(a) Slots 12 and 13 of input file "J" have each been wired to accept a 2- channel module.
(b) Field wiring for the primary detectors, except 24 volt DC power, shall terminate on either terminal board TB-9 in the controller cabinet or 6 position terminal board to be added by Contractor, depending on cabinet configuration. Where TB-9 is used, position assignments shall be as follows:

Position	Assignment
4 Channel A detector input,	1st module (Slot J-12)
5 Channel B detector input,	1st module (Slot J-12)
7 Channel A detector input,	2nd module (Slot J-13)
8 Channel B detector input,	2nd module (Slot J-13)

The Contractor shall add a 6 position terminal board to any 336 cabinet(s). Connection of auxiliary inputs shall require the installation of additional terminal facilities as shown in the details and diagrams. Auxiliary/phase sense harnesses per details and diagrams shall be installed in each cabinet to allow interfacing of phase green signals and if installed, auxiliary detector assembles.

D. 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:

1. Each system to be used for testing shall consist of an optical emitter assembly, an optical detector, at least 200 feet of optical detector cable, and a discriminator module.
2. The discriminator modules shall be installed in the proper input file slot of a Model 332 controller cabinet. The controller cabinet, together with a Model 170 controller unit with the appropriate operating program, a Model 210P monitor unit and 120 volt AC power will be available.
3. Two tests shall be conducted; one using a Class I signal emitter and a distance of 1,000 feet between the emitter and the detector, the other using a Class II signal emitter and a distance of 1,800 feet between the emitter and the detector. All range adjustments on the module shall be set to "Maximum" for each test.

4. Each above test shall be conducted for a period of one hour, during which the emitter shall be operated for 30 cycles, each consisting of a one minute "on" interval and a one minute "off" interval. During the total test period, (1) the emitter signal shall cause the proper response from the Model 170 controller unit during each "on" interval, and (2) there shall be no improper operation of either the Model 170 controller unit or the monitor during each "off" interval.

E. CERTIFICATES AND WARRANTIES
Manufacturers' certificates and warranties shall be presented to the Engineer.

86-45 Video Vehicle Detection
Normally, the City of Clovis is to provide equipment and City of Fresno personnel will install the cameras and set up programming in the cabinet. The Contractor shall provide all other equipment needed to accept video detection systems.

A. GENERAL
This Specification sets forth the minimum requirements for a Video Vehicle Detection System (System) that detects vehicles on a roadway using video images of the vehicle traffic and provides detector outputs to a traffic controller or similar device.

System Hardware: The System shall consist of one to four image sensor(s) or other video source(s), machine vision processor modules and extension modules, a central hub for switching and communications, a monochrome or color video monitor and a pointing device. The System hardware shall be complete and operational when properly installed. Substitution of components at additional cost or purchase of additional hardware shall not be required.

System Software: The System shall be able to detect vehicles in multiple lanes using the video image. A minimum of ninety-six (96) detection zones shall be user-definable through interactive graphics by placing lines and/or boxes in an image on a VGA or video monitor.

B. FUNCTIONAL CAPABILITIES
Four (4) video sources. The video sources can be video cameras or video tape players. The video shall be digitized and analyzed at a rate of 30 times per second. The System shall be able to detect the presence of vehicles in up to twenty-four (24) detection zones per camera. A detection zone is defined as an area the approximate width and length of an average size passenger car.

Detection zones shall be programmed via a menu displayed on a video monitor and a pointing device connected to the vision processor module without the need for a separate on-line personal computer. The menu shall facilitate placement of the detection zone. Detection shall be in “real-time” as the vehicles travel across each detector zone.

The System shall provide the ability to compensate for vibration and sway of the camera. Input images shall be automatically stabilized.

The System shall have an RS232 port for communications with an external computer, and shall have the capability to send and receive detector patterns to and from the external computer through the RS232 port. The System shall be remotely accessible for system reconfiguration or status monitoring.

The System shall have an intelligent central hub which functions as a central switching point between the processor modules and which will facilitate communications with a remote personal computer.

C. VEHICLE DETECTION

A minimum of ninety-six (96) detection zones shall be supported and each detection zone can be sized to suit the site and the desired vehicle detection region. Overall performance of the System shall be comparable to inductive wire loop detectors. Detection shall be at least 98% accurate under normal weather conditions, (days & night) and 96% accuracy under adverse or inclement conditions (fog, rain, snow etc.).

Detection zones may ANDed or ORed together to indicate presence on a single detector output channel. Placement of detection zones shall be done using a pointing device and a graphical interface built into the System and displayed on a video monitor. The setup program shall be included in the processor module. The creation and placement of detection zones shall be accomplished without the use of a personal computer.

When a vehicle is detected crossing a detection zone, the detection zone will flash a symbol on the video overlay display to confirm the detection of the vehicle. Detection zones shall be capable of being directional to reduce false detections from objects traveling in directions other than the legal direction of travel in the detection area.

The System shall reliably detect vehicle presence when the image sensor is mounted 30 feet or higher above the roadway, when the image sensor is adjacent to the desired coverage area and when the length of the detection area or field of view (FOV) is not greater than ten (10) times the mounting height of the image sensor. The image sensor shall not be required to be mounted directly over the roadway. A single image sensor, placed at the proper mounting height with the proper lens, shall be able to monitor six (6) to eight (8) traffic lanes simultaneously.

D. HARDWARE

Processor Modules

The System shall consist of video detection processor modules (and extension modules) which utilize edge card connectors that plug directly into Type 170 input files. Processor modules shall be available in single or dual video input configurations.

Detection inputs shall be transmitted to the controller via the standard Type 170 input file.

Each processor module shall be equipped with the following connections:

- BNC video input connector, NTSC
- BNC video output connector, NTSC
- Selectable 75 ohm or Hi-Z video input termination
- USB mouse or trackball port
- DB9 male connector for RS232 interface
- RJ-45 port for interconnection with extension modules

Software upgrades shall be accomplished via the serial port connection with no hardware modification required.

Extension modules, used to increase the detection zones of each camera, shall interconnect with the processor modules by means of RJ-45 ports. The extension modules shall be programmable from the processor modules, allowing remote programming of extension modules.

Central Hub

The System shall contain an intelligent central hub which functions as a central switching point for the video processors and accessories. This hub shall enable the user to switch between any of the peripheral processors without the need of switching any monitor, communication, or pointing device connections. The hub shall support industry standard 10/100Base-T communications and shall contain the following features:

- Supports 10/100Base-T autosense, full/half duplex
- Complies with 802.3 specifications
- Protocols supported: TCP/IP (TCP and UDP), ARP, ping, HTTP, ICMP, IGMP.
- Four (4) video inputs (via DB15 spider cable)
- Four (4) RJ45 extension module interface connectors
- One (1) RJ45 Ethernet connector
- One (1) EIA-232 local access port
- USB Mouse port
- One (1) BNC composite video out connector
- Edge connector compatible with the standard 170 input file

The System shall be designed to operate reliably in the adverse environment found in the typical roadside traffic cabinet. It shall meet the environmental requirements set forth by the NEMA (National Electrical Manufacturers Association) TS1 and TS2 standards as well as the environmental requirements for Type 170 controllers. Operating temperature shall be from -35° C to +74° C at 0% to 95% relative humidity, non-condensing.

E. IMAGE SENSOR

The cameras used for traffic detection shall be furnished by the system supplier and shall be qualified by the supplier to ensure proper video detection system operation.

The image sensor shall produce a useable image of the bodies of vehicles under all roadway conditions, regardless of time of day. The minimum range of scene luminance over which the camera shall produce a useable video image shall be the minimum range from nighttime to daytime, but not less than the range of 0.1 lux to 10,000 lux. The image sensor shall use a CCD sensing element and shall output monochrome or color video with resolution of not less than 350 lines vertical and 500 lines horizontal.

The image sensor shall be equipped with an auto-iris control based on an average scene luminance and shall be equipped with an auto-iris lens. The image sensor electronic circuitry shall include an optical filter to produce a satisfactory image at night.

The image sensor shall be housed, as a minimum, in a NEMA-4 water resistant dust proof enclosure. The housing enclosure shall be filed rotatable to allow proper alignment between the image sensor and the traveled road surface.

The image sensor enclosure shall include a thermostatically controlled heater to prevent the formation of ice and condensation in cold weather, as well as assure proper operations of the

lens' iris mechanism. The heater shall not interfere with the operation of the image sensor electronics, and it shall cause interference with the video signal.

The enclosure shall allow the image sensor to operate satisfactorily over an ambient temperature range from -29° F to +131° F and humidity range from 0% relative humidity to 100% relative humidity. The enclosure shall allow include a provision at the rear of the enclosure for connection of power and video signal cables fabricated at the factory. Input power to the environmental enclosure shall be 115 to 120 VAC @ 60 Hz.

The enclosure shall be equipped with a sun shield that prevents sunlight from directly entering the lens. The sunshield shall include a provision for water diversion to prevent rainwater from flowing into the camera field of view. The video output by the image sensor shall be RS170 format.

The image sensor shall include a variable focal length lens with variable focus that can be adjusted without opening the camera housing. The video signal shall be fully isolated from the camera enclosure and power cabling. All video connections for the image sensor to the interface panel shall be isolated from earth ground. The video output stage of the image sensor shall include transient protection to prevent damage due to voltage transients occurring on the coaxial cable leading from the image sensor to the processor modules.

F. INSTALLATION SUPERVISION

The supplier of the video detection system shall supervise the installation and testing of the System equipment. A factory certified representative from the supplier shall be on-site during installation.

Training shall be provided to personnel of the contracting agency or their authorized representative. Training duration time shall be required to insure the personnel of the contracting agency have received sufficient classroom training to properly set up, operate, and maintain the video detection system.

G. WARRANTY, MAINTENANCE AND SUPPORT

The System and all of its components shall be warranted by its supplier for a minimum of two (2) years from the date of installation at the project site. During the warranty period, the supplier shall repair with new materials, or replace at no charge, any product containing a warranty defect.

The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the system. These parts shall be available for delivery within thirty (30) days of placement of an acceptable order at the supplier's then current pricing.

The supplier shall maintain a program for technical support and software updates following expiration of the warranty period. Ongoing support by the supplier shall include upgrades of the system software. These upgrades/updates shall be provided free of charge.

86-46 Auxiliary Power System

The traffic signal power backup system shall be installed by the contractor in accordance with the manufacturer recommendations and specifications.

The traffic signal power backup shall include, but not be limited to, a shelf-mounted Clary SP1250PD-N(PLUS), or rack-mounted Clary SP1000SR (SN) as shown on the Plans or specified

in the Contract Specifications, with the OPB-1241 battery pack consisting of six (6) extreme temperature batteries, an external battery cabinet (Clary CBO-127 Style 3 or approved equal) mounted "piggyback" style onto the Model 332A controller cabinet, and any cables and connectors necessary to install the traffic signal power backup system in the controller cabinet, complete, in-place, and operational.

OVERVIEW

The Clary SP *Series* Traffic UPS is a turnkey, true on-line, power conditioner and battery backup or uninterruptible power system (UPS) designed for transportation and traffic applications. The Clary SP Series is capable of operating, up to its rated power level, in extreme environments, with existing equipment on the street today including a traffic signal controller cabinet complete with all ancillary devices and all signal heads (i.e., Incandescent, LED, Neon, etc.). Where shown on plans, the *SP Series* Traffic UPS shall be furnished and installed in conformance with the following specification.

1.0 Operation

A. The Traffic UPS shall be capable of producing – simultaneous – fully regenerated, conditioned and true sine wave, standby and continuous AC outputs.
B. Suggested operating mode for respective outputs during power failure:
   Continuous output provided for signal controllers and modems; Standby output provided for signals in flash mode operation (optional delay timer available for short-term battery run under full cycling operation).
C. Up to the maximum rating, the Traffic UPS shall be capable of running any combination of signal heads, whether Incandescent, LED or Neon, by any manufacturer, regardless of power factor, without overdriving the poorer power factor LED heads which may cause early degradation, low luminosity or early signal failure.
D. Upon loss of utility power the Traffic UPS shall insert battery power into the system via a supplied Power Interface Module (PIM). In case of UPS failure and/or battery depletion, the PIM will ensure that the UPS will drop out and, upon return of utility power, the traffic control system will default to normal operating mode.
E. The Power Interface Module (PIM) shall enable removal and replacement of the Traffic UPS without shutting down the traffic control system (i.e. "hot swap" capability). Connectors shall be equipped with a "safety interlock" feature.
F. For 170 or "California" style cabinets, upon loss of power the Traffic UPS shall actuate the existing Flash Transfer Relays (FTRs) and Mercury Contactor (MC) to force the traffic control system into Flash Mode operation.
G. Existing Flasher Modules and Flash Transfer Relays shall be utilized.
H. To facilitate emergency crews and police activities, the Traffic UPS shall be compatible with police panel functions (i.e. "Signals OFF" switch must kill power to the field wiring even when on UPS/Battery power).
I. The Traffic UPS shall not duplicate or take over flash operation or flash transfer relay functions.
J. The Traffic UPS shall be capable of providing continuous, fully conditioned, regulated, sinusoidal (AC) power to selected devices such as signal controllers, modems, communications hubs, NTCIP adapters and video equipment.

2.0 Description

The Clary, SP Series shall consist of two major components, the Electronics Module with an internal Power Interface Module, and the Battery System.

2.1 The Electronics Module shall consist of the following:

A. True sine wave, high frequency inverter utilizing IGBT Technology;
B. 3-stage, temperature compensated, battery charger;
C. For connection from the Electronics Module to the Power Interface Module and Battery System, dedicated harnesses shall be provided with quick-release, keyed, circular connectors and braided nylon sleeving over all conductors;
D. Local and remote control of UPS functions;
E. Local and remote communications capabilities;
F. Capable of accepting an NTCIP-ready adapter or a Spread Spectrum Radio modem.

2.2 Mounting/ Configuration

2.2.1 The complete Clary UPS system (batteries, SP1250 control unit, etc) shall be installed in the "piggyback" battery cabinet extension.

2.3 Battery System

2.3.1 The battery shall be comprised of extreme temperature, deep cycle, AGM/VRLA (Absorbed Glass Mat/ Valve Regulated Lead Acid) batteries that have been field proven and tested by the U.S. military.

2.3.2 The battery system shall consist of one or more strings (typically 4 or 6 batteries per string) of extreme temperature, deep cycle, AGM.NRLA (Absorbed Glass Mat/ Valve Regulated Lead Acid) batteries such as Clary Outpost™ batteries or equivalent.

2.3.3 Batteries shall be certified to operate at extreme temperatures from -40° F to +165° F.

2.3.4 The batteries shall be provided with appropriate interconnect wiring and shall be housed in an external battery cabinet.

2.3.5 The interconnect cable shall be protected with abrasion-resistant nylon sheathing.

2.3.6 The interconnect cable shall connect to the base module via a quick-release circular connector.

2.3.7 For purposes of safety and proper operation, the circular battery connector shall have interlocking pins to prevent turn-on if batteries are not connected, and to shut off the UPS should the batteries be disconnected.

2.3.8 Battery construction shall include heavy-duty, inter-cell connections for low-Impedance between cells, and heavy-duty plates to withstand shock and vibration.

2.3.9 The top cover shall use tongue and groove construction and shall be epoxied to the battery case for maximum strength and durability.

2.3.10 An optional lifting handle shall be available on most battery models.

3.0 Electrical Specifications

3.1 Input Specification

Nominal Input Voltage	120 VAC, Single Phase
Input Voltage Range	85 VAC to 140 VAC
Input Frequency	50 or 60 Hz (+/- 5%)
Input Configuration	3 Wire (Hot, Neutral & Ground)
Input Current (Max. draw)	7.2 amps, Power-Factor Corrected
Input Protection	Input Fuse (12 amps)

3.2 Output Specification

Nominal Output Voltage	120 VAC, Single Phase
Power Rating	1 kVA (1000VA/700W)
Output Voltage Regulation	+/- 2% for 100% step load change and from

	High battery to Low battery condition
Output Frequency	50 or 60 Hz (+J'- 5%)
Output Configuration	Keyed, circular connectors and duplex receptacle
Output Wave Form	True Sinewave
Overload capability	100% for 10 minutes 200% for 1/2 second
Fault clearing	Current limit and automatic shutdown
Short circuit protection	Current limit and automatic shutdown
Efficiency	85% at full load
Load Power Factor	0.7 lagging through unity to 0.7 leading

4.0 Physical Specifications, UPS Electronics Module

4.1 Dimensions:
Rack-mount: Width = 19 in., Depth = 16 in. (21 in. for 2 kVA), Height = 3.5 in. (2U)
Shelf-mount: Width = 19 in., Depth = 10 in., Height = 6 in.
Wall-mount: Width = 6.9 in., Depth = 9.5 in., Height = 16 in.
Detachable Power-Interface Module = Width = 6 in., Depth = 2.8 in., Height = 9 in.

4.2 Weight: UPS: 30 lbs., Shipping weight: 35 lbs.

5.0 Environmental Specifications

5.1 The UPS shall meet or exceed NEMA temperature standards from - 40° F to + 165° F.

5.2 The UPS shall be shall be certified and field proven to meet or exceed NEMA temperature standards. A certificate of compliance shall be made available upon request.

6.0 Battery Specifications

6.1 The battery system shall be certified and field proven to meet or exceed NEMA temperature standards from - 40° F to + 165° F.

6.2 Ampere-Hour ratings (see table 1).

6.3 Hydrogen gas emissions: must meet MIL-Spec #MIL-B-8565J

6.4 Dimensions: (see table 1)

6.5 Weights: (see table 1)

Table 1. Clary OUTPOST™ Batteries

		Amp-Hrs. Capacity (assumes 77° / 25"C,			**UNIT WEIGHT**	**OVERALL DIMENSIONS** Inches (cm.)		
Clary Pt. No.	Nominal Volts	3 Hour Rate	8 Hour Rate	20 Hour Rate	Lbs. (kg.)	Length L	Width W	Height H
OPB-1233*	12 VDC	24 A-H	31 A-H	33 A-H	23 (10.5)	7.68 (19.51)	5.15 (13.08)	7.22 (18.34)
OPB-1241	12 VDC	32 A-H	39 A-H	41 A-H	29 (13.2)	7.68 (19.51)	5.15 (13.08)	7.22 (21.59)
OPB-1251*	12 VDC	36 A-H	48 A-H	51 A-H	32 (14.5)	9.41 (23.90)	5.22 (13.26)	9.35 (23.75)

*Available with handles. Add "H" to part no. when requesting.

7.0 Communications, Controls & Diagnostics

7.1 Alarm Function Monitoring:
The traffic UPS shall come standard with a DB-9F connector with open collectors (40 V @ 20 mA) indicating:

a) Loss of Utility Power;
b) Inverter Failure; and
c) Low Battery.

7.2 An RS232 Interface shall be provided via a DB-9F connector allowing full, interactive, remote computer monitoring and control of the UPS functions.

7.3 Front Panel controls: Power ON, Cold (DC) Start, Alarm Silence, Battery Test, Bypass Breaker, and DC/Battery Breaker.

8.0 Reliability

8.1 Calculated MTBF is 100,000 hours based on component ratings.

8.2 When Bypass and Power Interface Module are included, system MTBF increases to 150,000 hours.

9.0 Options

9.1 Delay-timer to provide up to 3 minutes of full cycling while on battery before switching to flash mode (only available where 100% low-power/LED signals and pedestrian heads are used).

9.2 Fast-Charge battery charger (2.5 amps or higher).

9.3 UPS-Link. Internally mounted STMP/NTCIP adapter.

9.4 Spread-Spectrum radio modem with Intelligent Routing software, 112.5 kpbs transmission rate.

9.5 Tripp Connector: a 12 VDC power inserter to allow maintenance vehicles to power the system indefinitely.

9.6 Input Transient Voltage Surge Suppressor (TVSS).

9.7 Extended run times via additional batteries.

10.0 Serviceability L Maintainability

10.1 MTTR (Mean-Time-To-Replace or Repair)

10.1.1 Electronics: 15 minutes or less,

10.1.2 Battery System: 15 minutes or less.

11.0 Warranty

Standard warranty terms cover entire Traffic UPS including battery. Terms are one-year parts and labor with labor F.O.B. factory. JITS and Hot Swap programs are available - please consult factory for more details.

12.0 Manufacturer

The manufacturer of the SP1250 PD-N(Plus) *Series* Traffic UPS shall be Clary Corporation, located at 1960 S. 'Walker Ave., Monrovia, CA 91016 Phone: (800) 44-CLARY.

13.0 Battery Cabinet

The battery cabinet shall be a NEMA-3R rated enclosure constructed of 0.125” aluminum with an anodized finish matching the finish on the Model 332 controller cabinet. The cabinet shall be provided with a continuous hinge door equipped with a neoprene door gasket, a three point latching system, and shall be keyed alike to be compatible with the controller cabinet locks currently in use throughout the City of Clovis. The battery

cabinet shall provide cooling and ventilation by means of a thermostatically controlled 120 VAC exhaust fan, a louvered front door with a removable air filter, and a roof overhang which is perforated for a natural flow of cooling air. The cabinet shall contain four (4) adjustable, removable, full width metal shelves. Shelves shall be approximately 10-3/8" deep. Overall cabinet dimensions shall be approximately 58" in height by 25" in width by 12" deep. Clary CBS-127 Style 3, or approved equal.

13.1 Battery Cabinet Mounting

The external battery cabinet shall be mounted "piggyback" style to the Model 332A controller cabinet as shown on the plans using six (6) 3/8" diameter zinc plated or stainless steel hex head cap screws with flat washers, lock washers, and hex nuts as required. A raceway for the interconnecting cables and wiring between the battery cabinet and the controller cabinet shall be provided by appropriately sized zinc plated, malleable iron chase bushings installed between the two cabinets. Chase bushings shall be equipped with steel locknuts and plastic insulating bushings.

The battery cabinet exhaust fan shall be connected to terminals T1-3 (AC-) and T1-5 (AC+) in the controller cabinet by means of two No. 14 AWG conductors.

86-47 Measurement And Payment

Unless otherwise specified in the Contract Specifications, Traffic Signal and Safety Lighting Installations will be measured and paid for on a lump sum basis. Where more than one traffic signal installation location is included in the contract, each signal installation location will be identified and paid for separately. Payment shall include all costs for a complete installation as shown on the Plans and as specified in the Contract Specifications, all to the satisfaction of the Engineer, including all labor, materials, and incidentals required for a complete and functioning signal system.

SECTION 87 (BLANK)

MATERIALS

SECTION 88 - ENGINEERING FABRICS

Engineering fabrics shall be as specified in Section 88, "Engineering Fabrics," of the State Standard Specifications.

SECTION 89 (BLANK)

SECTION 90 - PORTLAND CEMENT CONCRETE

Portland Cement Concrete shall be as specified in Section 90, "Portland Cement Concrete," of the State Standard Specifications.

SECTION 91 - PAINT

Paint shall be as specified in Section 91, "Paint," of the State Standard Specifications.

SECTION 92 - ASPHALTS

Asphalts shall be as specified in Section 92, "Asphalts," of the State Standard Specifications.

SECTION 93 - LIQUID ASPHALTS

Liquid Asphalts shall be as specified in Section 93, "Liquid Asphalts," of the Stata Standard Specifications.

SECTION 94 - ASPHALTIC EMULSIONS

Asphaltic Emulsions shall be as specified in Section 94, "Asphaltic Emulsions," of the State Standard Specifications.

SECTION 95 - EPOXY

Epoxy shall be as specified in Section 95, "Epoxy," of the State Standard Specifications.

APPENDIX

STATE OF CALIFORNIA DEPARTMENT OF HEALTH SERVICES

M e m o r a n d u m

Date: April 14, 2003 **(Revised Date: October 16, 2003)**

To: Regional and District Engineers

From: David P. Spath, Ph.D., Chief *(Original signed by Dave*
Drinking Water and Environmental Management
601 North 7th Street, MS 216
Sacramento, CA 95814 (916) 322-2308

Subject: **GUIDANCE MEMO NO. 2003-02: GUIDANCE CRITERIA FOR THE SEPARATION OF WATER MAINS AND NON-POTABLE PIPELINES**

The purpose of this memo is to update guidance dated April 5, 1983 for consistency with proposed 2003 regulations. Should there be any modification to the proposed Water Works Standards that may impact the content of this guidance, the guidance will be amended accordingly.

GUIDANCE: CRITERIA FOR THE SEPARATION OF WATER MAINS AND NON-POTABLE PIPELINES

BACKGROUND

When buried water mains are in close proximity to non-potable pipelines, the water mains are vulnerable to contamination that can pose a risk of waterborne disease outbreaks. For example, sewers (sanitary sewer mains and sewage force mains) frequently leak and saturate the surrounding soil with sewage due to structural failure, improperly constructed joints, and/or subsidence or upheaval of the soil encasing the sewer. If a nearby water main is depressurized and no pressure or negative pressure occurs, that situation is a public health hazard that is compounded if an existing sewer is broken during the installation or repair of the water main. Further, failure of a water main in close proximity to other pipelines may disturb their bedding and cause them to fail. In the event of an earthquake or other disaster, simultaneous failure of all pipelines could occur.

The most effective protection against this type of drinking water contamination is adequate construction and separation of non-potable pipelines and water mains. The Waterworks Standards (Title 22, Chapter 16, Section 64572) provide separation criteria for new construction. However, when these criteria cannot be met, the risk of contamination can be reduced by increasing the structural integrity of pipe materials and joints, and ensuring minimum separation requirements are met. Therefor, the following guidance details construction criteria for the installation of water mains and non-potable pipelines to minimize the risk of contamination of drinking water.

DEFINITIONS

- COMPRESSION JOINT - A push-on joint that seals by means of the compression of a rubber ring or gasket between the pipe and a bell or coupling.
- CONTINUOUS SLEEVE - A protective tube of high-density-polyethylene (HDPE) pipe with heat fusion joints or other non-potable metallic casing without joints into which a pipe is inserted.
- DISINFECTED TERTIARY RECYCLED WATER - Wastewater that has been filtered and subsequently disinfected in accordance with Section 60301.230, Chapter 3 (Water Recycling Criteria), Title 22, California Code of Regulations.
- HOUSE LATERAL - A sewer line connecting the building drain and the sanitary sewer main serving the street.
- SUPPLY LINE - Pipelines conveying raw water to be treated for drinking purposes in accordance with Section 64572 ©, **proposed** Water Works Standards.
- WATER MAIN – Means any pipeline, except for user service lines, within the distribution system in accordance with Section 64551.70, **proposed** Water Works Standards.
- RATED WORKING WATER PRESSURE - A pipe classification system based on internal working pressure of the fluid in the pipe, type of pipe material, and the thickness of the pipe wall.
- SANITARY SEWER MAIN - A gravity sewer conveying untreated municipal wastewater.
- SEWAGE FORCE MAIN - A pressurized sewer conveying untreated municipal wastewater.

APPLICABILITY

Note that the construction criteria presented in this document apply to house laterals that cross above a water main, but not to those house laterals that cross below a water main.

Water mains or non-potable pipelines that are 24-inches in diameter or larger may pose a higher degree of public health concern because of the large volumes of flow involved. Therefor, installation of water mains or non-potable pipelines 24-inches in diameter or larger should be reviewed and approved in writing by the Department on a case-by-case basis prior to construction.

In no case, should water mains and non-potable pipelines conveying sewage or other liquids be installed in the same trench.

REGULATORY REQUIREMENTS

Any new development project in which all the underground facilities are being constructed for the first time must comply with the following regulatory requirements:

Existing requirements:

Section 64630.(Title 22 CA Code of Regulations) Water Main Installation"

(c) Water mains shall be installed at least:
  (1) Ten feet (3 meters) horizontally from and 1 foot (0.3 meters) higher than sanitary sewer mains located parallel to the main.
  (2) One foot (0.3 meters) higher than sanitary sewer mains crossing the main.
  (3) Ten feet (3 meters), and preferably 25 feet (7.5 meters), horizontally from sewage leach fields, cesspools, seepage pits and septic tanks.

(d) Separation distances specified in (c) shall be measured from the nearest outside edges of the facilities.

(e) Where the requirements of (c) and (d) cannot be met due to topography, inadequate right-of-way easements, or conflicts with other provisions of these regulations, lesser separation is permissible if:
  (1) The water main and the sewer are located as far apart as feasible within the conditions listed above.
  (2) The water main and the sewer are not installed within the same trench.
  (3) The water main is appropriately constructed to prevent contamination of the water in the main by sewer leakage.

(f) Water mains shall be disinfected according to AWWA Standard C601-81 before being placed in service.

(g) Installation of water mains near the following sources of potential contamination shall be subject to written approval by the Department on a case-by-case basis:
  (1) Storage ponds or land disposal sites for wastewater or industrial process water containing toxic materials or pathogenic organisms.
  (2) Solid waste disposal sites.
  (3) Facilities such as storage tanks and pipe mains where malfunction of the facility would subject the water in the main to toxic or pathogenic contamination.

Although the following requirements have not yet been adopted, they should be within the next two years and should be used as guidance for future construction.

Proposed requirements as of the date of this document:

Section 64572. Water Main Separation

(a) New water mains and new supply lines shall not be installed in the same trench as, and shall be at least 10 feet horizontally from, and one foot vertically above, any parallel pipeline conveying:

(1) Untreated sewage,
(2) Primary or secondary treated sewage,
(3) Disinfected secondary-2.2 recycled water (defined in section 60301.220),
(4) Disinfected secondary-23 recycled water (defined in section 60301.225), and
(5) Hazardous fluids such as fuels, industrial wastes, and wastewater sludge.

(b) New water mains and new supply lines shall be installed at least 4 feet horizontally from, and one foot vertically above, any parallel pipeline conveying:

(1) Disinfected tertiary recycled water (defined in section 60301.230), and
(2) Storm drainage.

(c) New supply lines conveying raw water to be treated for drinking purposes shall be installed at least 4 feet horizontally from, and one foot vertically below, any water main.

(d) If crossing a pipeline conveying a fluid listed in subsection (a) or (b), a new water main shall be constructed perpendicular to and at least one foot above that pipeline. No connection joints shall be made in the water main within eight horizontal feet of fluid pipeline.

(e) The vertical separation specified in subsections (a), (b), and (c) is required only when the horizontal distance between a water main and pipeline is ten feet or less.

(f) New water mains shall not be installed within 100 horizontal feet of any sanitary landfill, wastewater disposal pond, or hazardous waste disposal site, or within 25 feet of any cesspool, septic tank, sewage leach field, seepage pit, or groundwater recharge project site.

(g) The minimum separation distances set forth in this section shall be measured from the nearest outside edge of each pipe barrel.

ALTERNATIVE CRITERIA FOR CONSTRUCTION

Water Mains, and Sewers and Other Non-potable Fluid-carrying Pipelines

When new water mains, new sanitary sewer mains, or other non-potable fluid-carrying pipelines are being installed in existing developed areas, local conditions (e.g., available space, limited slope, existing structures) may create a situation in which there is no

alternative but to install water mains, sanitary sewer mains, or other non-potable pipelines at a distance less than that required by the regulations [existing Section 64630 (proposed Section 64572)]. In such cases, through permit action, the Department may approve alternative construction criteria. The alternative approach is allowed under the proposed regulation Section 64551(c):

"A water system that proposes to use an alternative to the requirements in this chapter shall demonstrate to the Department how it will institute additional mitigation measures to ensure that the proposed alternative would not result in an increased risk to public health."

Appropriate alternative construction criteria for two different cases in which the regulatory criteria for sanitary sewer main and water main separation cannot be met are shown in **Figures 1 and 2**.

- **Case 1** - New sanitary sewer main and a new or existing water main; alternative construction criteria apply to the sanitary sewer main.

- **Case 2** - New water main and an existing sanitary sewer main; alternative construction criteria may apply to either or both the water main and sanitary sewer main.

Case 1: New Sanitary Sewer Main Installation (Figures 1 and 2)

Zone Special Construction Required for Sanitary Sewer Main

A. Sanitary sewer mains parallel to water mains shall not be permitted in this zone without prior written approval from the Department and public water system.

B. If the water main paralleling the sanitary sewer main does not meet the Case 2 Zone B requirements, the sanitary sewer main should be constructed of one of the following:

   1. High-density-polyethylene (HDPE) pipe with fusion welded joints (per AWWA C906-99);
   2. Spirally-reinforced HDPE pipe with gasketed joints (per ASTM F-894);
   3. Extra strength vitrified clay pipe with compression joints;
   4. Class 4000, Type II, asbestos-cement pipe with rubber gasket joints;
   5. PVC sewer pipe with rubber ring joints (per ASTM D3034) or equivalent;
   6. Cast or ductile iron pipe with compression joints; or
   7. Reinforced concrete pressure pipe with compression joints (per AWWA C302-95).

C. If the water main crossing below the sanitary sewer main does not meet the requirements for Case 2 Zone C, the sanitary sewer main should have no joints within ten feet from either side of the water main (in Zone C) and should be constructed of one of the following:

1. A continuous section of ductile iron pipe with hot dip bituminous coating; or
2. One of the Zone D options 1, 3, 4, or 5 below.

D. If the water main crossing above the sanitary sewer main does not meet the Case 2 Zone D requirements, the sanitary sewer main should have no joints within four feet from either side of the water main (in Zone D) and be constructed of one of the following:

1. HDPE pipe with fusion-welded joints (per AWWA C906-99);
2. Ductile iron pipe with hot dip bituminous coating and mechanical joints (gasketed, bolted joints);
3. A continuous section of Class 200 (DR 14 per AWWA C900-97) PVC pipe or equivalent, centered over the pipe being crossed;
4. A continuous section of reinforced concrete pressure pipe (per AWWA C302-95) centered over the pipe being crossed; or
5. Any sanitary sewer main within a continuous sleeve.

Case 2: New water mains Installation (Figures 1 and 2)

Zone Special Construction Required for Water Main

A. No water mains parallel to sanitary sewer mains shall be constructed without prior written approval from the Department.

B. If the sanitary sewer main paralleling the water main does not meet the Case 1 Zone B requirements, the water main should be constructed of one of the following:

1. HDPE pipe with fusion welded joints (per AWWA C906-99);
2. Ductile iron pipe with hot dip bituminous coating;
3. Dipped and wrapped one-fourth-inch-thick welded steel pipe;
4. Class 200, Type II, asbestos-cement pressure pipe;
5. Class 200 pressure rated PVC water pipe (DR 14 per AWWA C900-97 & C905-97) or equivalent; or
6. Reinforced concrete pressure pipe, steel cylinder type, per AWWA (C300-97 or C302-99 or C303-95.

C. If the sanitary sewer main crossing above the water main does not meet the Case 1 Zone C requirements, the water main should have no joints within ten feet from either side of the water main (in Zone C) and be constructed of one of the following:

1. HDPE pipe with fusion-welded joints (per AWWA C906-99);
2. Ductile iron pipe with hot dip bituminous coating;
3. Dipped and wrapped one-fourth-inch-thick welded steel pipe;
4. Class 200 pressure rated PVC water pipe (DR 14 per AWWA C900-97 & C905-97); or
5. Reinforced concrete pressure pipe, steel cylinder type, per AWWA (C300-97 or C301-99 or C303-95).

D. If the sanitary sewer main crossing below the water main does not meet the requirements for Case 1 Zone D, the water main should have no joints within eight feet from either side of the sanitary sewer main (in Zone D) and should be constructed as for Zone C.

Water Mains and Pipelines Conveying Non-potable Fluids

When the basic separation criteria cannot be met between water mains and pipelines conveying non-potable fluids, the requirements described above for sanitary sewer mains should apply. This includes the requirements for selecting special construction materials and the separation requirements shown in Figures 1 and 2. Note that not all construction materials allowed for sanitary sewer mains will be appropriate for other non-potable fluid lines. For example, certain plastic lines may not be appropriate for the transport of some fuel products. The selection of compatible materials of construction for non-potable fluids is a decision to be made by the project engineer.

Water Mains and Sewage Force Mains

- Sewage force mains shall not be installed within ten feet (horizontally) of a water main.

- When a sewage force main must cross a water main, the crossing should be as close as practical to the perpendicular. The sewage force main should be at least one foot below the water main.

- When a new sewage force main crosses under an existing water main, and a one-foot vertical separation cannot be provided, all portions of the sewage force main within eight feet (horizontally) of the outside walls of the water main should be enclosed in a continuous sleeve. In these cases, a minimum vertical separation distance of 4 inches should be maintained between the outside edge of the bottom of the water main and the top of the continuous sleeve.

- When a new water main crosses over an existing sewage force main, the water main should be constructed of pipe materials with a minimum rated working pressure of 200 psig or the equivalent.

Water Mains and Tertiary Treated Recycled Water or Storm Drainage

The basic separation criteria for water mains and pipelines conveying tertiary treated recycled water or storm drainage lines are a 4-foot horizontal separation where lines are running parallel and a 1-foot vertical separation (water line above recycled or storm drainage) where the lines cross each other.

When these criteria cannot be met, the Zone A criteria apply where lines are running parallel, and the Zone C and Zone D criteria apply where the lines cross each other as shown on Figures 1 and 2. For these situations, the Zone "P" criteria are in effect and prohibit construction less than 1 foot in parallel installations and less than 4 inches in vertical (crossing) situations.

For tertiary treated recycled water and storm drainage lines, the Zone B criteria (requirements for special pipe) do not apply as the basic separation criteria is a four-foot horizontal separation criteria for parallel lines. The tertiary treated recycled water lines should be constructed in accordance with the color-coding, and labeling requirements per Section 116815, California Health and Safety Code of Regulations.

MISCELLANEOUS GUIDANCE

- More stringent requirements may be necessary if conditions such as high groundwater exist. HDPE or similar pipe may be required to provide flexibility to move without potential joint leaks.

- Sanitary sewer mains should not be installed within 25 feet horizontally of a low head (5 psig or less pressure) water main.

- New water mains and sanitary sewer mains should be pressure tested in accordance with manufacturer's specifications.

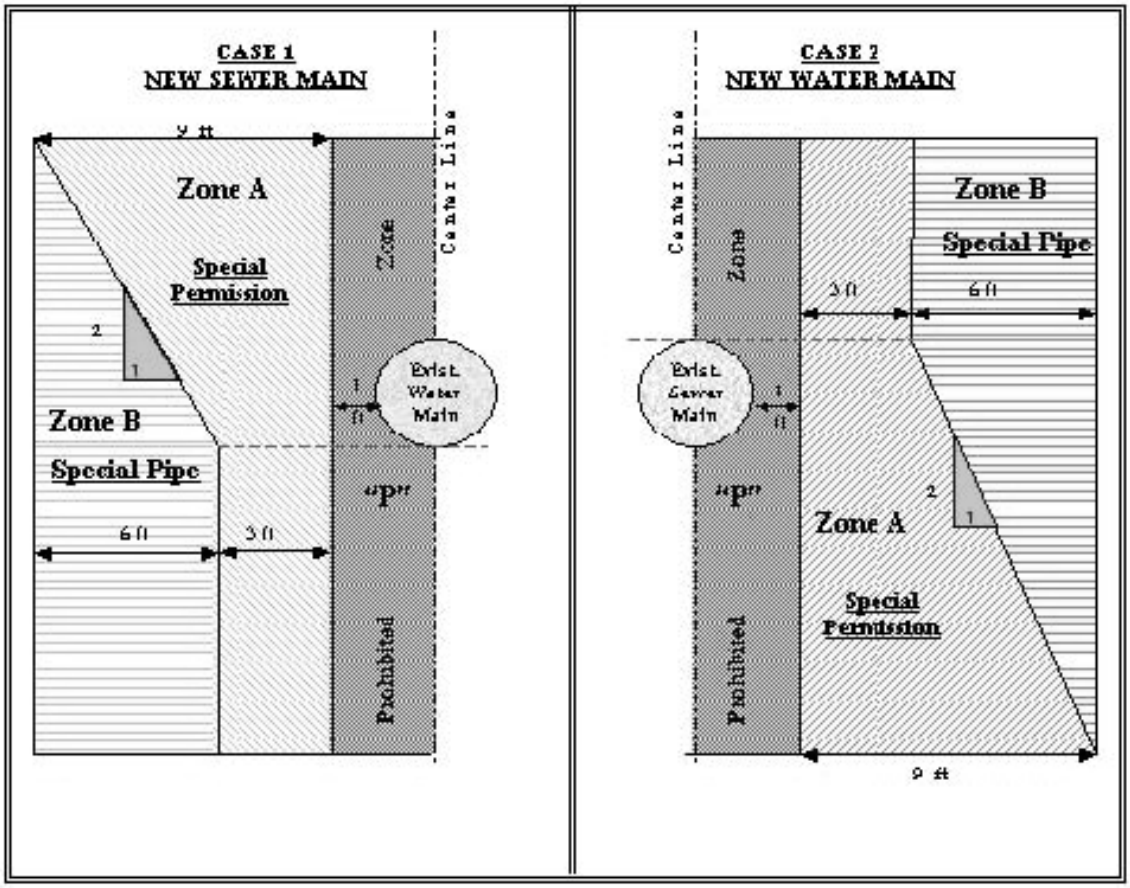
- When installing water mains, sewers, or other pipelines, measures should be taken to prevent or minimize disturbances of existing pipelines. Disturbance of the conduit's supporting base could eventually result in pipeline failure.

- Special consideration should be given to the selection of pipe materials if corrosive conditions are likely to exist. These conditions may be due to soil type and/or the nature of the fluid conveyed in the conduit, such as a septic sewage producing corrosive hydrogen sulfide.

NOTE: Dimensions are from the outside of the water main to the outside of the other pipeline, manhole, or sleeve.

FIGURE 1 PARALLEL CONSTRUCTION

Not To Scale



Note: Zones identical on either side of center lines.

Zones "P" is a prohibited zone. Section 64630 (e) (2) California Code of Regulations, Title 22 (Current); or Section 64572 (a) California Code of Regulations, Title 22 (Proposed).

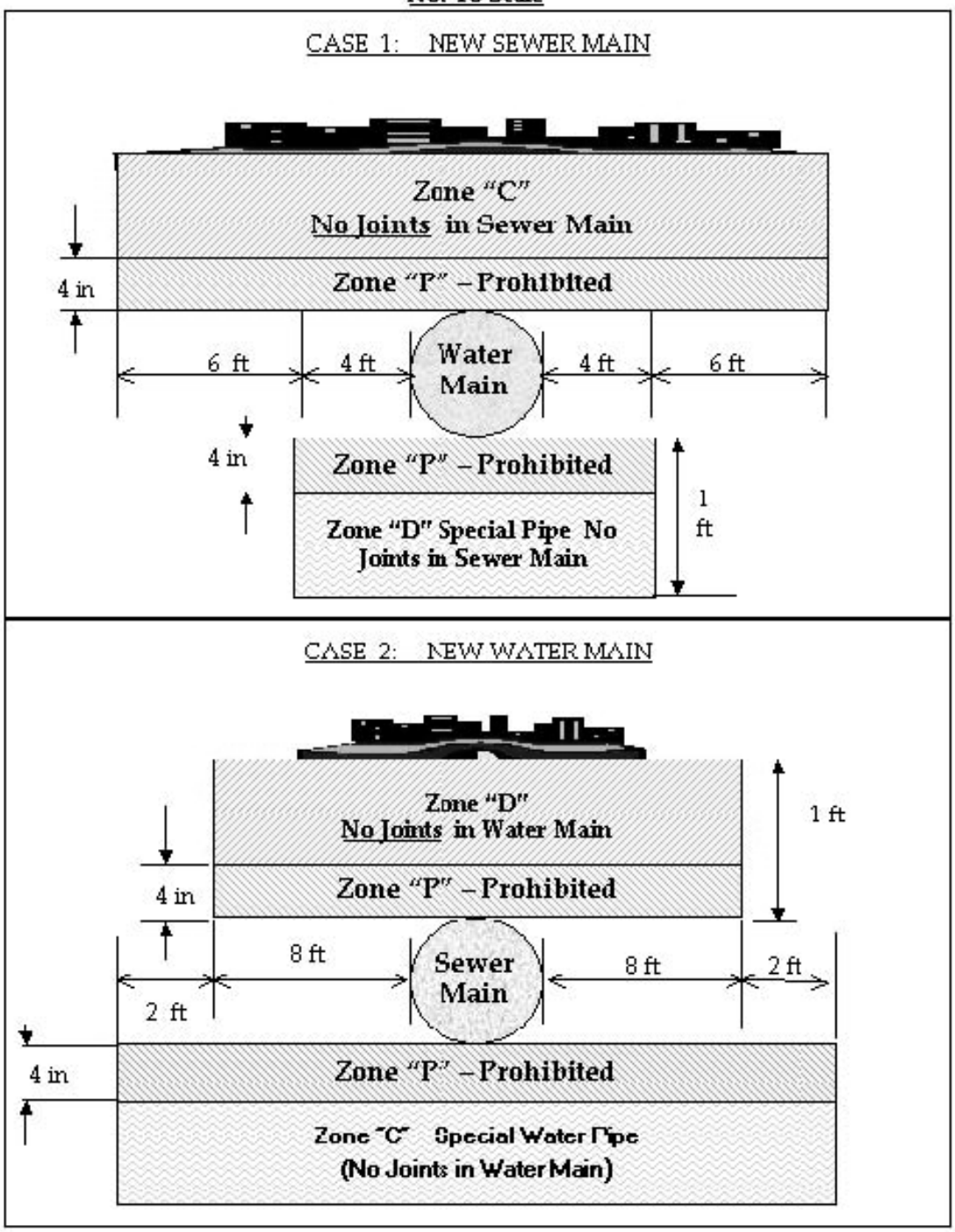



FIGURE 2 CROSSINGS
Not To Scale